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ABSTRACT

This report describes in detail the DELTA (Developing European Learning through Technological Advance) 1990 program, which was designed to address issues related to the use of new emerging technologies in the areas of information technology, telecommunications, and broadcasting, for learning. Six chapters cover the following topics: (1) Background, including the need, the technologies, DELTA preparation, world state of the art in educational technology, impact assessment and forecast, Operation 1992, and the Electronic University; (2) Objectives and Current Status, including a description of the objectives, program technical audit, strategic review, and requirements of the board report; (3) Overview of Program Structure, including the action lines and interactions of action lines; (4) Action Line I--Learning Systems Research, Action Line II--Collaborative Development of Advanced Learning Technology, Action Line III--Testing and Validation of Communications and of Satellite-based Open Facility for Testing, Action Line IV--Interoperability, and Action Line V--Promotion of Favorable Conditions; (5) Management of the Program, including project management and management audit; and (6) Overview of Current Standards in the DELTA Domain, including standards for the learner environment, learner interface, and telecommunications. Appendices contain summaries of DELTA projects; a brief overview of the DELTA preparatory studies; and a list of DELTA contractors in order by country. (DB)

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R+D in Information and Communication based learning technology

DELTA '90

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DELTA '90

Development of European Learning through Technological Advance

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1. BACKGROUND

1.1 The Need

In the last fifteen years or so, a number of factors have contributed to a major change in the status of distance education as an appropriate and effective mechanism for the education and training of adults.

Economic changes have radically altered the skills required by enterprises. This has meant rethinking the objectives of, in particular, the initial education system.

The pace of economic change has also led to an increased demand for continuing education provision.

The large number of people made redundant from declining traditional industries has also produced a need to retrain the unemployed.

Significant changes in demographic profiles that are under way or predicted have also prompted a renewed concern to ensure that there will be a sufficient supply of necessary key skills for future economic demands.

Advances in new educational technologies have further stimulated the interest in distance learning for man education, as an integral part of existing educational structures.

In Europe it is estimated that 22% of the population are in some form of full time education at any one time and more than 10 million undergo some form of training or retraining every year. This amounts to 85 million people in education or training each year.

1.2 The Technologies

DELTA addresses issues related to the use, for learning, of new emerging technologies in the areas of Information Technology, Telecommunications and Broadcasting. The aim is to allow more effective use to be made of training material by reducing the cost of production of quality software and support mechanisms.

Utilisation of Telecommunications, Broadcasting and IT for education and training will contribute to the competitive edge in Europe by offering advanced knowledge skills at low cost for commercial users, including SMEs. It will also provide an additional tool to influence social and regional imbalances across Europe, and facilitate integration across cultural borders. Those processes will also be carried out more cost effectively than by traditional methods. Interesting developments are occurring in such areas as the use of satellites, software incorporating Artificial Intelligence (AI) features and in integrated systems for educational usage.

The early 1980s witnessed a major growth in ownership of video recorders and personal computers. This gave new possibilities for usage for education and or training purposes. The late 1980s are witnessed the expansion of satellite broadcasting, and the possibility to transmit voice and data signals using only a fraction of the capacity of a television channel. The eighties have also seen significant developments in electronic publishing, electronic mail and computer conferencing, interactive video and advanced software for computer-based learning (CBL).

The advent of electronic publishing facilitates the constant updating of materials, as well as joint production across institutions. Common standards are not yet available for electronic mail. "Old" technologies can still be extremely effective and with the advent of widespread cassette ownership they are widely accessible. Recent experience has shown that well designed audio cassettes are efficient at relatively low cost. Video film offers unique characteristics but the cost of production is still very high.

Very interesting applications have already been developed in the use of videodiscs, mainly for usage by large companies or specialised institutions. There is great potential here for education, either as a stand-alone system or in combination with a Personal Computer (PC). However, the technological future of this in education is still uncertain. The NeXT computer, sometimes called the "Desktop University" is the first personal computer that is geared solely towards educational use and providing massive exchangebale optical disk storage at an affordable price. It is available now.

The advent of the new generation of powerful PCs, and the reduction in cost of business standard (MS-DOS, UNIX) computing equipment has greatly enhanced opportunities for computer-based learning. Computers are used currently, though mainly for teaching about computers themselves. They are used as "tools" such as word processing, spreadsheets and access to databases. They are also useful for communication of data and text cost-effectively, through public and private networks. Thus more open-ended communication is possible.

CBL has been enhanced through new software developments, including authoring skills, which incorporate some limited AI features. There are some significant applications here, but they require sophisticated systems for development and usage of materials. Full AI and integrated "intelligent tutoring" are not yet available, and CBL in general is currently a minority component of all distance learning.

Broadcasting is also important as a method of audio-visual distribution, and it is available to all. It is estimated to be one of the cheapest ways (e.g. for numbers greater than 500 students through radio, or 1,000 through television). New developments concerning deregulation and competition could however change this situation, with negative effects for quality education.

The number of terrestrial cable links to neighbouring countries is increasing, but terrestrial broadcasting production remains expensive for educational purposes alone, and is not undertaken much.

Satellites are being used in education all over the world and the late 1980s is seeing a major expansion also in Europe. Usage includes updating courses in advanced technologies for industry, professional updating for doctors, etc., and also educational institutions.

Satellites offer considerable benefits for education and training but cooperation between countries is essential if those benefits are to be realized. European cooperation is also beginning with respect to new types of course design, incorporating combinations of technologies. This is important both for cost reduction and avoiding cultural ethnocentricity. However, PTT control over uplinks and tariffs is of vital importance here, and usable satellite regulations for Europe are needed.

1.3 DELTA - Preparation

DELTA Preparatory Studies

The DELTA Exploratory programme was prepared by a series of industry driven "Preparatory Studies", which were commercially published as the "DELTA Blue Book". These studies were successfully concluded and summarised into a publication that was widely disseminated. This was published in 1987 by the publishers Les Editions du Logiciel.

The issue of the Learning System Reference Model (LSRM) appeared especially difficult at that time, and a special investigation was commissioned to consider that component as a prelude to an operational model being in place in time for the DELTA Exploratory Action projects to commence in March 1989.

Pre-Pilot Learning Systems Reference Model Study

This was known as the "Pre-Pilot Study". It was a major consortium of leading actors, from large IT vendors to educational publishers (Bull, Klett Verlag, MacMillan Intek, Olivetti, Open University, Philips, CEN Saclay, SESA, SIDAC and Twente University).

The objective was to develop a framework for the LSRM in respect to three types of usage in a DELTA action :

- basis for communications between parties in the programme, by providing terminology etc.
- as a reference tool, checklist for output of current and future DELTA Projects, and to manage interdependancies
- as a tool for the identification and management of critical processes in programme management.

The study identified a number of non-orthogonal dimensions to the problem which are illustrated by Figure 1.1.

A brief overview of the DELTA Preparatory Studies and the Framework of the DELTA Pre-Pilot Project for the LSRM are included in Annex B.

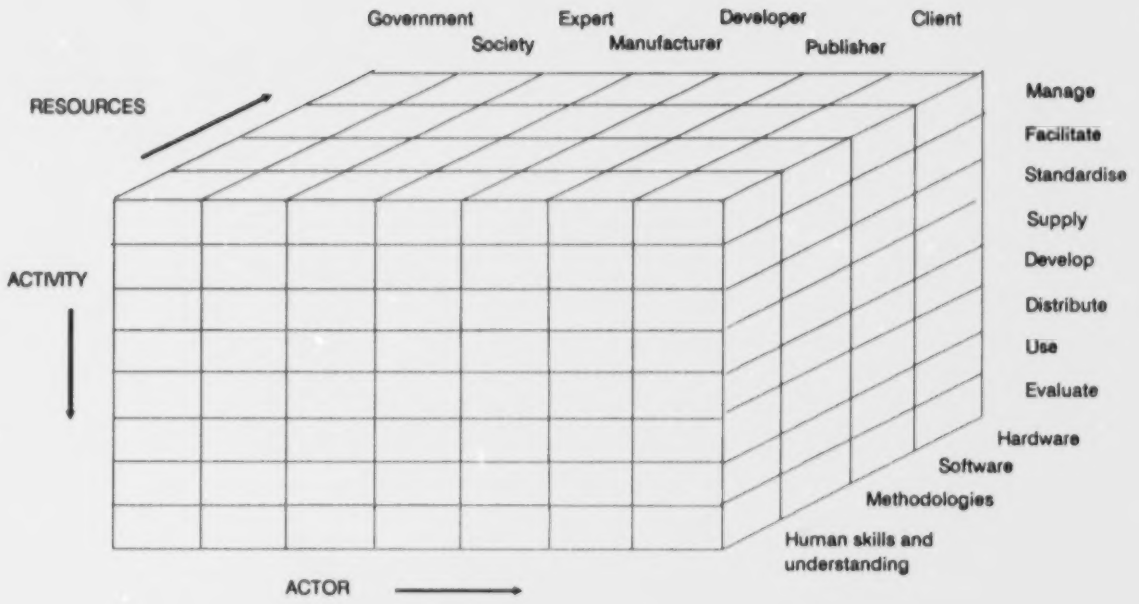


Figure 1.1 : The Multiple Dimensions of Learning Systems

The DELTA Exploratory Action

The DELTA exploratory action was approved by the Council of Ministers on 29 June 1988 and the DELTA Workplan was adopted that same day, at the first meeting of the DELTA Management Committee.

Under the terms of the Council "DELTA" decision, the programme is managed by the Commission, with co-responsibility resting with the DELTA Management Committee, which is delegated by the Council of Ministers with responsibility for R&D in the member states.

This formal committee is supplemented by a high level strategic advisory board ("SRB") and a more technically oriented requirements board ("RB"). Each board consists of a wide range of actors; industrial and academic, to ensure a broad range of opinion is available for guidance. A typical excerpt from the terms of reference of these boards is given in the panel below.

The Call for Proposals was formally launched on 2 July 1988, with a closing date on 31 October 1988. A total of 163 complete proposals had arrived in time to be included in the evaluation process. Over 1,000 instances of participating organizations caused the oversubscription of the workplan resources by a factor of over 10. Over 36,000 man months were requested against 3500 man months available. All member states were represented and the proposals covered all tasks of the Workplan, though not in a consistent depth. Leading IT industry, publishers, broadcasting, education, training and telecommunications actors aimed to build on emerging work in other programmes to develop a pragmatic approach. The learning interests and human factors were additional points that came out of proposals and there seems to be a good mixture of pedagogic, academic, user and industry mixes in many of the proposals.

The result of the call for proposals was confirmed by the DELTA Management Committee on 2.12.88 with the adoption of 28 projects by the DeMC, and a further 3 on 3.3.89. All contracts on Action Line IV were signed by the 21.12.88. Negotiations with one consortium failed to reach a satisfactory conclusion. The general starting date of the projects has been the 1st of March 1989, and the duration of the projects is generally 24 months.

1.4 World State of the Art in Educational Technology

The state of the art in the European Community countries is described in the paper entitled "Open and Distance Learning Projects in the European Community: The State of the Art"[1], prepared within the Commission. Its main conclusions are that there is an increasing interest in the domain, both by industry and government. Education and training is becoming a crucial factor partly as a consequence of past complacency - hence Europe has a lot of catching up to do - and partly because of the combination of the increasing pace of change and the increasing complexity of technology aids creating a need to improve skill levels in education, retraining and redeployment. The paper also notes that ongoing and emerging projects on open and distance learning are still limited by some factors such as:

- lack of more advanced technologies;
- separation between education and industry;
- virtually no multilinguality;
- poor interactivity and tutoring systems;
- no common unifying infrastructures;
- lack of cross-certification between programmes;
- few attempts to investigate pedagogic aspects.

The Nordic group of countries have combined to collaborate on an identical approach to that of the DELTA Exploratory Action, down to the workplan level.

State of the art information gathered on a study tour of the United States, the far east, Australasia and Canada has enabled DELTA actors, the Commission and the Member States to reflect upon present work and future plans within a worldwide market related framework. Dissemination of the gathered information in the form of a separate consolidated report is proceeding via a proposed book and special editions of a professional journal.

The study tour revealed how important it is to follow-up the research and development done in the DELTA Exploratory Phase. The new projects announced in the North American countries, if they become fully exploited, will be severe competition for the European ALT industry. Projects such as the Smart Library and the Knowledge Network II will provide users with a flexible, multimedia distributed learning environment at the workplace, where the trainee is coached and advised, access to an interactive communication system and a support structure within an overall service model. It will also give access to electronically formatted data and information in different media, enabling organisations and business to receive training courses via satellite and telecommunications technology.

A number of specific issues stood out in the review of the state of the art world wide. It revealed that several new ideas on training and educational technology are emerging which will fundamentally change the future scene in the domain of education and training.

Concepts such as the Virtual Library, DEUCE, new forms of learning and training, design and production tools identified in the Operation 1992 investigations are, in fact, closely aligned with current implementation ideas in the US and Canada.

A major conclusion from the review of the worldwide state of the art is that the DELTA approach and its potential impact is rather unique. Nowhere else was such a concerted and international strategy applied to the domain of education and training as in DELTA, and everywhere people considered the DELTA approach as very important and relevant for the future of implementations and applications of educational technologies.

1 Ref: de1025, August 23,1989.

The study identified also a series of economic trends all over the world which indicate the need for improved training and education opportunities. It showed a shift from a traditional focus on career, technical and vocational distance education for individual entry-level students towards a primary emphasis upon the training and upgrading of employees in the workforce. This shift confirms the trend mentioned in the literature towards the importance of lifelong learning! Educational technologies will be used less as a supplement to conventional teaching and training than towards the use of integrated and flexible distributed learning environments where the trainee is coached and advised by intelligent performance aids and tools.

For there to be a growing world-wide market for off-the-shelf generic learning material, it must be presented in such a way that it can easily be 'packaged', adapted to not only local learning needs but also to linguistic, pedagogic and cultural conditions.

Common issues which emerged from the study tour include:

- small business training, and responding effectively to employer based training needs in the small business sector (SMEs).
- The very high demand for information on assessment, evaluation and marketing of educational technologies, which is virtually non-existent today.
- The need for initiatives to reduce costs, time and actual development and production resources.
- A demand by less developed countries for the development of low-cost workstations which are highly interoperable, user-friendly and adaptable to regional differences not only for delivery of courseware but also allowing for distance tutoring.
- Intelligent tools for design, production and transcribing learning materials.
- The adaptation of existing, purchased, learning materials (such as textbooks and television programmes) to local circumstances (translation, adaptation to local needs, learning styles, cultural identity). These issues are also emerging in the Community, via DELTA.
- The language issue has been a major research and discussion problem in all countries, particularly with regard to computer based translations.
- Another issue is the relation between the use of educational technology tools and the availability of good-quality, self-instructional material for flexible learners. This is acute in the case of developing countries where the resources and people necessary for the development of good-quality materials are not available.

Learners or trainees at home or at the workplace will no longer be traditionally trained or educated but will educate themselves while performing. The learner environment will provide all the multimedia and telecommunication facilities to help and advise the student when required.

It appears that this is what flexible learning is all about.

1.5 Impact Assessment and Forecast

The changing life style and the current rate of change requires rational examination and a considered attempt to document the issues of the day, consider what their impact could be and assess their socio-economic effects - both direct and side effects. The IAF document, currently in preparation as a stand alone report, follows an extensive consultation and information gathering and synthesis process and pools knowledge of the state of the art in advanced learning technology. It asks critically about the future answers to such questions as :

- **Where to learn?** - home, during employment etc.
- **When to learn?** - leisure time, in-service etc.
- **How to learn?** - with technology, tutoring, self motivated
- **What to learn?** - technology, management of change, complexity etc.

This document forms part of the underlying rationale for continued Community interest in the area of applying advanced learning technology to the education and training issues of the day. The IAF assesses the state of the art and the current trends in each of these issues. The main contents cover:

- What are learning technologies? System standards, storage and information representations, telecommunications and ISDN, configurations for specific learning scenarios - the home, in-company and institutional learning.
- Developments in design and production environment, tools and functionalities to be supplied to the production and distribution chain, communications evolution, multi media image banks and access techniques.
- Socio-politcal and Economic Implications, covering industry, large and SME organisations, public and private sectors, and regional issues.
- Potential market demand and the problems of related supply - production and distribution chain, terminal equipment, rural areas and special needs.
- Learning Technology Pedagogics - tutoring under ALT, help and support systems, monitoring and management of the learner and the processes of learning, modelling learners, didactic strategies, human support use of ALT, intelligent tutoring strategies, simulation and explorative environments, collaborative and group learning and the psychological, motivational and human factors in flexible learning systems and their use.
- Demonstrating ALT effectiveness and the related cost benefit anaylsis, evaluation of processes and skills attainment and related design methodologies.
- Specific application areas considered include disabled people, language learning, collaborative or co-operative learning, Exploratory learning and the use of simulation and modelling techniques.
- Regulatory and Structural aspects covered include copyright protection, mobility and centres of ALT excellence, personal learning systems, information clearing houses and resource centres. Evolutionary strategies are also proposed for them.

1.6 Operation 1992

As part of the brief to better position the member states in the domain of DELTA, a planning exercise was conducted in parallel with the projects to scope the potential requirements of a major strategic action.

The process of deriving technically aligned specifications is described in the later section on management of the programme. However, a number of socio-economic and political criteria must be added to these specifications. Operation 1992 (see figure 1.2) provided this policy framework.

General criteria included :

Criteria related to the cohesion within Community policy objectives:

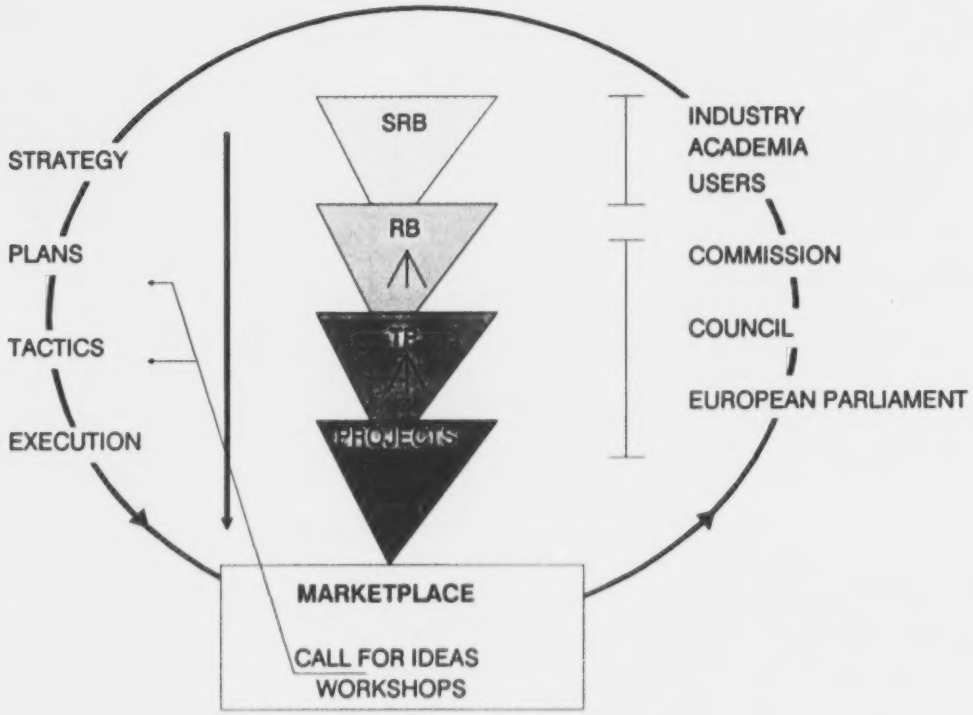
- contribution to the establishment of a common market
- contribution to the harmonious development of economic activities
- contribution to closer relations between the Member States;
- contribution to regional development;
- strengthen the international competitiveness

Criteria used to establish subsidiarity

- strategic importance for Europe's future performance;
- necessity or significant added value in the transnational cooperation;
- commitment of the sector actors and support of national administrations;
- strengthening international competitiveness and competition;
- ability of the Commission to establish consensus on credible actions;
- Commission ability to assure professional implementation.

Criteria applying to the approach

- cooperation with the sector actors in the definition of the action;
- open competition for the realization of the work;
- horizontal and vertical cooperation;
- sharing of necessary background technology and results.



TECHNICAL PANEL I → LEARNING TECHNOLOGIES
TECHNICAL PANEL II → LEARNING TECHNOLOGIES INFRASTRUCTURES
TECHNICAL PANEL III → LEARNING TECHNOLOGIES PEDAGOGICS

Figure 1.2 : DELTA OPERATION 1992

By retaining flexibility in its implementation, and emphasizing portability, interoperability and medium to long terms standards strategy, projects can adopt relevant and timely developments out of the extension of the Framework Programme.

DELTA is in an area which covers many technologies and application domains even outside the Community Framework programme for RD&T. It therefore cannot afford to be independent of the final customers, it needs close liaison with strategic initiatives in the various domains to which DELTA supplies a new capability.

Operation 1992 offered a series of technological options to be considered in order to consolidate the unique progress and momentum gathered to date in the domain.

The detailed investigations of Operation 1992 were undertaken by three panels of independent experts. Panel 1 dealt with the range of educational and related technologies, Panel 2 with infrastructure and generic applications, while Panel 3 worked on the specific human and pedagogic issues that are unique to distance and open learning. The panels took into account the many ideas provided as a result of the Call for Ideas issued by the Commission in February 1989.

The Operation 1992 Report on the "Results of an investigation into the requirements and options in Developing European Learning through Technological Advance, GE0187" strongly emphasised the need for consolidation and further extension of the DELTA programme. It presents detailed requirements for additional work to be undertaken in building on the Exploratory Action under the following proposed Action Lines:

Implementation Strategies : definition of common functional specifications and standards necessary to form an integrated educational electronic service for flexible and distance learning at European level;

Technological Research: development of technologies to meet the needs of training services, it includes the three basic environments envisaged - learning, production and information - and communications;

Pilot Testing and Validation: providing systematic validation by field testing of services for distance and flexible learning, assessment of the performance and positive actions for uptake of advanced learning technologies by the educational market.

The three action lines are interrelated and they constitute a coherent and systematic approach aimed at reaching a significant improvement in the domain of learning technologies and services at a pan-European level.

1.7 Electronic University

The Electronic University was a supporting conclusion from Operation 1992. It defines an implementation strategy for the delivery of learning, tutoring and monitoring with access to information and support systems via computer-based networked connectivity. It is intended as a framework under which pilot experiments can place themselves within a structure that ensures continuity of experiment, access to developing functionality and width while retaining strong links with emerging technology.

Europe needs to complement the conventional training and education system with services which permit the level of "access" to knowledge, expertise and skills renewal which industry and commerce need. In order to achieve this, two preconditions have to be met:

- The training and educational community needs to be able to experiment with new learning technologies, both to improve its own familiarity with new techniques and to develop solutions to the pedagogic problems associated with distance training.

- A policy to develop infrastructure services has to be agreed with the main actors in the field - principally the industrialists who will become increasingly dependent on their staff's ability to "access" knowledge, expertise and skills, and educationalists who will have to exploit new technologies.

Electronic networks offer the possibility of improving the pedagogic value of distance learning. Educational institutions are already exploring this area. The use of such networks for training and educational purposes is increasing, both as a means of familiarising students with the principles of on-line interaction and as a means of supplying courseware to distance learners.

To ensure that networks are exploited effectively and that educationalists and trainers are able to progress along the learning curve as new telecommunications services become available, it is necessary to devise an evolutionary strategy towards ITT&B. Such a strategy would benefit by working in conjunction with techniques under development within RACE. The Electronic University is conceived in these terms.

This "service infrastructure" can be conceived, in abstract terms, as a "university" which - like the classical university - has no direct pedagogic function but does provide a serviced environment within which pedagogists can operate effectively. This modern "electronic" university would provide the electronic network support services which would not only allow current distance learning projects to expand but which would also facilitate an incremental, evolutionary development towards the use of advanced communications services in the mid to late 1990's.

2. OBJECTIVES AND CURRENT STATUS

2.1 Objectives

The overall purpose of the Community's R&D activity is to enhance the global competitiveness of industry and the quality of life of its citizens, while giving special consideration to redressing regional, social and special needs imbalances.

DELTA is a research and development programme in the domain of education, training, re-training and continuous training. Learning is the one continuous process which underlies most activities of advanced society, both in terms of individuals and as organisations and structures.

Specific objectives within the different Action Lines of the DELTA Workplan amount, in the technical domain, to the DELTA approach creating an advanced learning environment on top of existing and emerging technology.

The DELTA Exploratory action is a tightly interconnected set of 30 projects which will concentrate on the following key issues :

- building on existing developments that are emerging out of more technology oriented programmes such as ESPRIT and RACE,
- the actors willingness to collaborate, in a domain where there is no history of IT industry, PTT's, software houses, educational experts and publishers, multi-media publishers and broadcasters working toghether on a strategic scale,
- building for future consensus, so that the actors in the domain can better position themselves for developing standards intercept strategies, and a common platform and environment baseline,
- detailed technical work on issues where different possibilities require exploration, and whose experience and lessons can be brought into a strategic action at a later date,
- develop a basic infrastructure at a European level, so that the results obtained can be promulgated into a knowledgeable audience, and articulated with domain actors outside the contractual framework of the immediate projects,
- demonstrating some prototype results, of various projects which will form the basis of further work and integration activities.

The DELTA Exploratory Phase must help to prepare a strategically sized initiative which will demonstrate that the developments can be used to

- prepare the learning and training industry in the member states for the emerging and common market in educational tools and services,
- enable cost effective learning by the user to take place, and offer adaptive systems that respond to user needs,
- stimulate private investment in the domain, with models of payback and copyright protection for intellectual work,
- increase the cost effectiveness of learning
- overcome regional difficulties
- solve regional, sectorial problems and special needs on a European level by optimising the commonality of the problem domains by collaboration and cooperation,
- prepare a basis for external promotion of the services created above.

2.2 Programme Technical Audit

The Audit Procedure

To be able to adapt the Exploratory Action to the development of technology and to evolving changes in the perception of demand, the DELTA Decision foresaw a workplan established to define the detailed objectives, the type of projects and actions to be undertaken and the corresponding finance plans.

The progress of all the on-going projects must be reviewed annually with respect to the objectives of the workplan and in the light of possible future needs for work to be addressed within DELTA. The 1989 Technical Audit of the DELTA Exploratory Action included the following major elements:

- The partners in each project carry out a "self-evaluation" by reviewing the project in all its essential aspects and document the results of this evaluation in the Annual Review Report of the Project.
- The Annual Review Reports are evaluated by independent external experts (Auditors) identified with the help of DeMC. Following the evaluation of the reports the projects are given a "hearing" under the chairmanship of the Commission. The Projects had the opportunity to highlight achievements and to outline future work. The Auditors, grouped in Panels according to their respective expertise, question the projects so as to complete the picture given by the Annual Report and the Presentation.
- The Audit Report of the external experts is complemented by an assessment of the contractual deliverables by the Project Officers of the Commission (in general the deliverables are considered confidential and are not disclosed to the Auditors).
- The Panels consolidate their conclusions and recommendations to the DeMC and to the Commission

Results of the Technical Audit

The first technical audit of DELTA Projects was held by 14 internationally recognized experts, and the official report of the 28 Projects audited says:

- no Projects have been completed, but none were expected to finish;
- 23 Projects have been recommended for continuation with some observations to be taken into account in the negotiation of any adaptation of the Technical Annexes;
- 4 Projects have received support for continuation subject to compliance with substantial recommendations in the adaptation of the Technical Annex and/or Project Management Procedures;
- 1 Project has encountered serious reservations which could lead to the recommendation to consider discontinuation. This project is currently working to address the 17 recommendations made after an in depth review.

2.3 Strategic Review

The DELTA exploratory phase was charged with the responsibility of investigating the evolving relationship between new technology and learning. Initial reflections within DELTA reveal a complex domain in which technology, cultural diversity, personal motivation and cost interact in a way which inhibits easy solutions to Europe's growing training problem. The complexity of the domain, the rapidly changing technological environment and the necessity of ensuring that Community action is directed towards cost-effective learning technologies make essential a periodic review of the key issues raised by technology and learning.

That is the reason for an annual Strategic Review. The review consists of an investigation by the Strategic Advisory Board (SRB) which consists of independent personalities from different backgrounds and viewpoints, all of whom are familiar with strategic political and technical developments.

In April 1990, the SRB reported the findings of the Strategic Review in the document "Priorities for New Training and Learning Technology in the 1990s". It identified a number of key issues under the following main headings:

- Identifying the problem;
- Cultural Factors;
- Market related factors;
- Technological Factors;
- Relationships with other initiatives

The SRB recommendations for action are shown in the panel below.

SRB Recommendations for Action

- The Community should undertake a number of large scale experiments in flexible learning via electronic networks. These experiments are needed in order to test the logistics and viability of training and educational services in real, large scale network learning situations. In the same context the Community should explore the possible benefits of a European Electronic University.
- Telecommunications costs are a major barrier to the development of distance learning in educational institutions. The Community must find ways of reducing the cost of telecommunications tariffs to educational and training institutions and of reducing the costs of hardware and software.
- The private sector is increasingly important in the development of training services, especially in the relationship between private organisations and educational institutions. The Community should continue to provide support for the development of a dynamic private sector training industry. A forum in which the public and private sector could share strategic thinking might be of benefit.
- The relationship between rapid innovation in learner technology, changing training requirements and learner needs, should be investigated. An educational technology investigation is needed possibly contributing to a new conceptual framework for flexible and distance learning.
- A formal system of evaluating the long term benefits of current Community programmes in educational technology should be introduced. This should provide an administrative mechanism for ensuring the evaluation of specific programmes and overall Community policy.
- The Commission should provide better coordination between DELTA and other Community programmes and policies. Development of an educational technology support system should be coordinated with Community structural policy, as well as the DG's V, XVI and XXIII, and the TF-HR.

2.5 Requirements Board Report

The Terms of Reference of the Requirements Board include the following statement:

"The mission of the Requirements Board (RB) is to address on an industrial implementation strategy level future requirements and options in distance and open learning in the light of international developments and specific European conditions. The scope is to include all industrial, service and technological aspects which are relevant to defining a consistent strategy for actions of sector actors including, where required, the advancing of governmental actions. the scope has to be correspondingly comprehensive and take into account the domains of convergence between IT, Telecom and Broadcasting including both stationary as well as mobile usages."

Within a series of meetings the Requirements Board set out to achieve the following results :

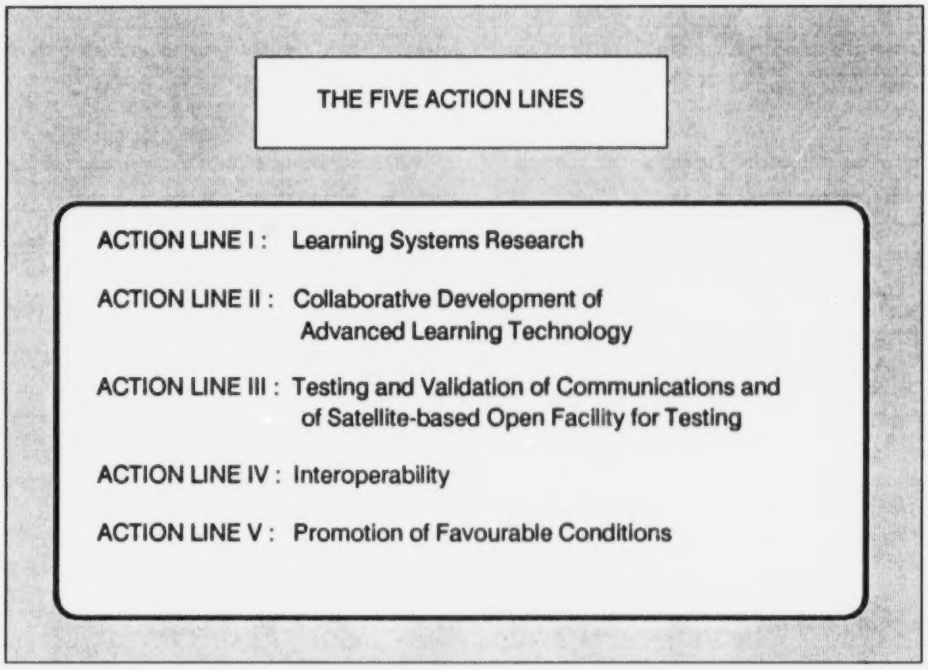
- Identification of requirements and options in IT&T as required to support sustained economic, industrial and social progress;
- Identification of the objectives and milestones to be achieved in industrial and services developments;
- Identification of the associated technological capabilities are of importance for Europe to possess in an open international competition for equipment and service provision;
- Identification of the domains for which cooperation on a European scale offers significant advantages either in terms of financial resources, expertise, risk reduction or time-saving;
- Formulation of recommendations for the Revision of the Framework Programme for European co-operation in RD&T.

The summary of the findings were presented to the DELTA Management Committee and to the Strategic Review Team by the Chairman of the RB. Its principal recommendations are shown in the panel opposite.

Principal Recommendations of the Requirements Board

- For every action there must be a clear market rationale. If it is not known WHY an investment is made and what its payback potential is, then it will not be made. Vocational training / retraining is the first target group in the flexible social Europe of "full" employment.
- The existing educational system must be examined, decision makers identified and educated for change, but DELTA cannot intervene directly, only indirectly.
- Work specified must be incremental, with flexibility and with intermediate successes, or generic spin-off at different stages, which is important for visibility and credibility. Flexibility is crucial in R&D of this nature.
- Educationalists must play a stronger role in shaping the future, and must be trained to exploit new approaches It is clearly not well addressed in DELTA Exploratory Phase. More mainstream educationalists are in the panels.
- The aims of DELTA must be clear before the Requirements Board can function properly. But DELTA is what the actors decide is needed, therefore it is the Requirements Board function to define objectives and broad shape.
- An objective of DELTA must be to enable people to make better decisions about educational technology. Information networks; human, paper or electronic, are an essential component of a strategic programme based on collaboration, concertation and cooperation.
- The need for incremental type work reduces risk, as well as increasing visibility and concept of success, which helps momentum and perception of success. Investments are protected also.
- Problems are not only technical but are often frustratingly trivial. Special recognition should be given to factors affecting use, or lack of use, of technology in learning in the infrastructure domain.
- Economies of scale to satisfy growing demand only plausible through collaboration and cooperation, since collaboration gives value for money in R&D through the multiplier effect.
- If we are to offer educational services, with technology we must convince that the technology stands up to it,because it is not done currently and is the mistake of the past maybe. We emphasize the complete systems view of learner, tutor and development environments.
- **Services, of whatever nature, must satisfy real end user needs.**

3. OVERVIEW OF PROGRAMME STRUCTURE


THE FIVE ACTION LINES
ACTION LINE I : Learning Systems Research
ACTION LINE II : Collaborative Development of Advanced Learning Technology
ACTION LINE III : Testing and Validation of Communications and of Satellite-based Open Facility for Testing
ACTION LINE IV : Interoperability
ACTION LINE V : Promotion of Favourable Conditions

3.1 The Action Lines

ACTION LINE I: Learning Systems Research

The objective of action Line I is to optimise the use of advanced learning technologies in Europe. Action Line I is primarily concerned with the development of mechanisms for the exchange and dissemination of information on these technologies. A central theme of Action Line I is the creation of a European Learning Technology Association. The formation of this was completed in 1990. From the initial approach to some 4,000 people interested in the domain, over 25% have expressed a positive wish to be associated. ELTA will be used as a promotional vehicle to disseminate DELTA information outside the immediate vicinity of the contractors, and to offer a process whereby external input can be gathered for the guidance of the projects - notably by capture of expressed user requirements. There will be a number of topic specific work groups. A DELTA seminar in late 1989 will be followed by a full DELTA conference in October 1990.

ACTION LINE II: Collaborative Development of Advanced Learning Technology

The objective of Action Line II is to complement efforts to meet learning needs and to achieve incrementally the design of systems and equipment to support Community-wide open learning. Action Line II harnesses to learning systems advances already under development for other purposes and builds on identified progress in the relevant technologies and communications services. A central concept of this Action Line is that of a Portable Educational Tool Environment which will facilitate the production and transfer throughout Europe of high quality course-ware and information resources. This will enable a consistent software/hardware/services architecture to be developed.

ACTION LINE III: Testing and Validation of Communications and of the Satellite Based Open Facility for Testing

Action Line III reflects the pragmatic needs of actors to experiment with modern telecommunications methods in learning, in order to test the distance learning paradigm in a variety of circumstances under different carrier conditions. It is a well defined area of work in which the information technology needs of systems are complemented by communications services.

ACTION LINE IV: Interoperability

Action line IV deals with interoperability. This is the ability for two or more (or one replicated) pieces of software to operate interchangeably, either as components of a larger system on different hardware in distributed mode, or to replace each other and accomplish similar goals by mutual substitution. Amongst its objectives are the identification of standards requirements and the promotion or development of specific standards for interoperability in advanced learning technology.

ACTION LINE V: Promotion of Favourable Conditions

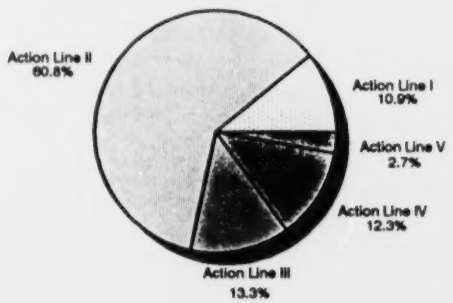
This action line deals with the factors affecting the use of technology for learning. There are a plethora of reasons why investment or political decisions are made that affect the pattern of investment, or the penetration of a particular technology in such a diverse domain. This area tries to identify some of the issues, while being acutely aware that the resolution of the issues is often outside the control of the technologists!

Specifically, it looks at issues of

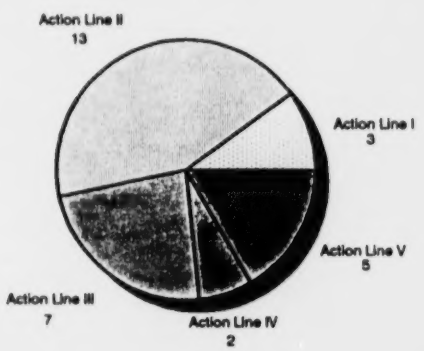
- Fiscal treatment of learning system technology
- Regulatory Conditions under which learning is done
- Telecommunications policy such as tariffing for learning
- Electronic copyright and intellectual property.

RESOURCE ALLOCATION - DELTA ACTION LINES

Percentage of Total Project Budget



NUMBERS OF PROJECTS - DELTA ACTION LINES



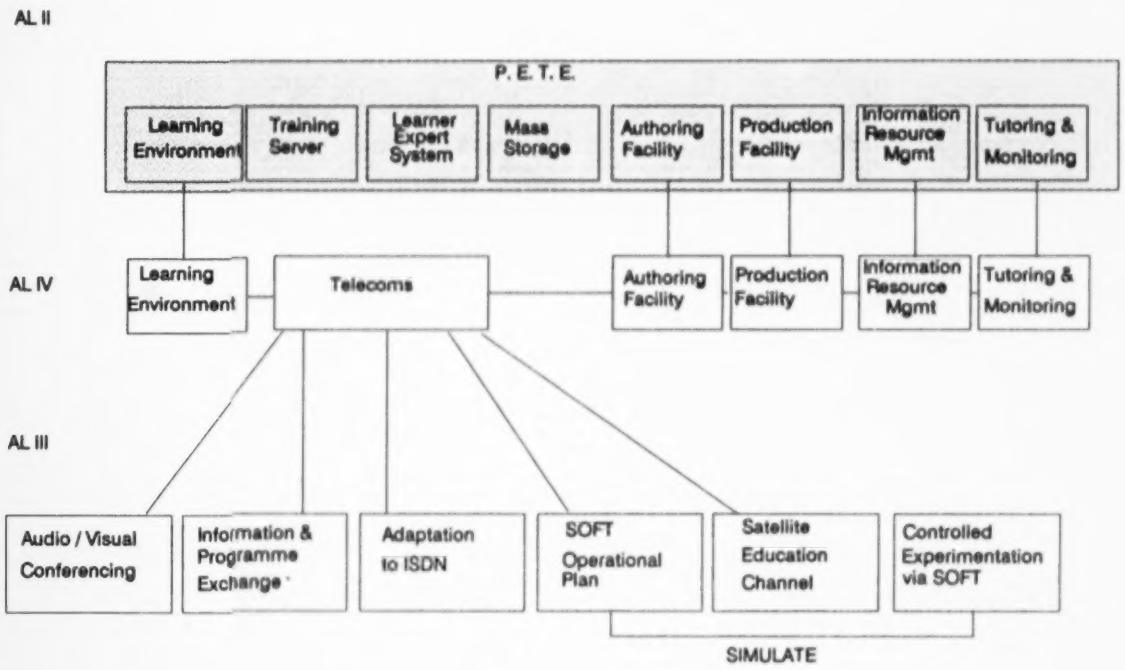


Figure 3.1 : Task Structures of AL II and AL IV

3.2 Interactions of Action Lines

Whilst the above Action Lines are convenient subdivisions of the Programme, technically they are frequently considered in the following groupings :

Action Lines (AL) I and V may be considered as information infrastructure action lines. AL I concerned with the various consultation processes to maintain contact with all domain actors, and AL V concerned with factors affecting the introduction of technology into learning structures.

Action Line II and IV are related in the technical domain - AL II is concerned with the incremental engineering for the technology, AL IV with the long term strategy for standards to emerge.

Action Line III is exclusively involved in experimentation with existing means of telecommunications (including satellites) and in planning how to place these technologies in the correct systems context when applied to learning.

Action Lines are also far from being independent areas of activity. For instance Action Line II concerns itself with emerging technologies, but these also have a long range strategy via an interoperability objective through Action Line IV.

An indication of the interactions between Action Lines is given by Figure 3.1 which reflects the relative positions of the task structures in AL II and AL IV, and relates those of AL III schematically to the information technology tasks.

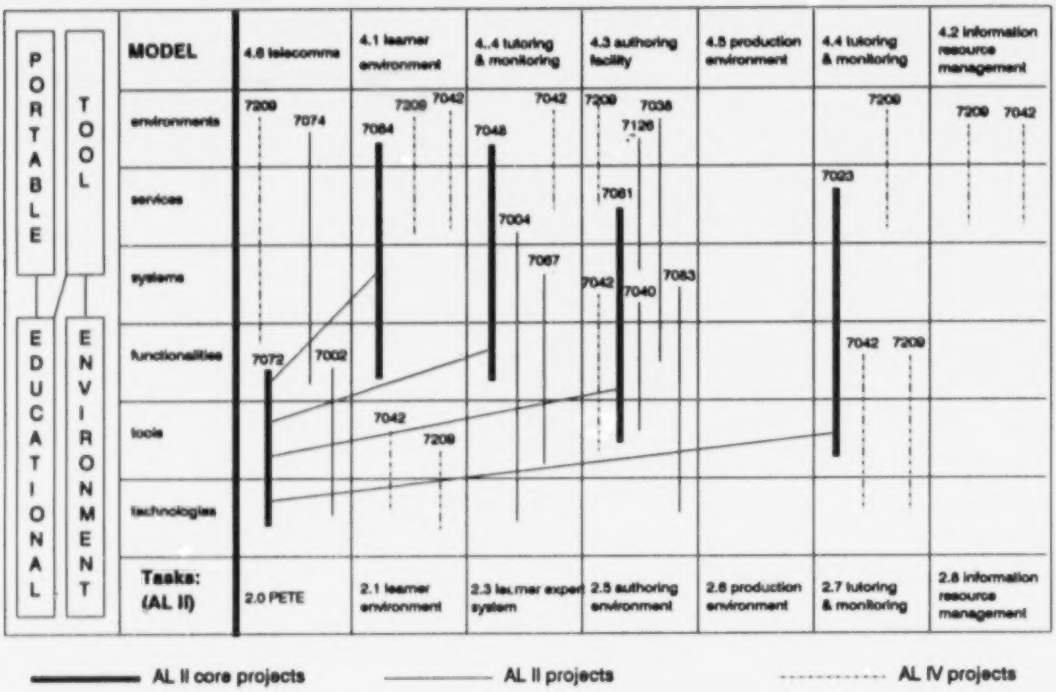


Figure 3.2: Action Line II & IV - Project Overview and Core Project Relations

Figure 3.2 graphically illustrates the rather complex relationships that have been developed between the projects in Action Line II and IV. The top line tasks are Action Line IV - long term standards oriented strategies, whereas the lower axis reflects the tasks in Action Line II. The main column on the extreme left shows the level of functionality at which the PETE concept is developed; as a measure between the short term technology and longer term standards oriented approach. The second column from the left shows a series of functional levels of the discourse model used to locate projects.

The model refers at its highest level to the fulfilment of the objectives contained in particular environments, such as the learner environment, the distributed learning environment and the authoring & production environment. This approach therefore does not concern itself with the political, educational or social imperatives and concerns which will nevertheless affect them. These are made explicit where necessary in the description and analysis of specific issues.

The open and distance learning concept can be described by means of a 6-layer hierarchical model with the following components :

LAYER 1 "basic technologies"

Technologies are the lowest level of the model and refer to the hardware and its operating system software, its peripherals, display devices, communications and the variety of interfaces needed for interoperability at a generic hardware and software level.

LAYER 2 "tools & equipment"

Tools & equipment are the hardware and software elements upon which functionalities are built, such as speech and OCR recognition, peripherals, communication networks (LAN, WAN and VAN), ISDN and high definition video.

LAYER 3 "functionalities"

Functionalities are identified at a conceptual level as the components of one or more services which provide the means to accomplish that service eg. high level interfacing, transport and storage functions and management functions.

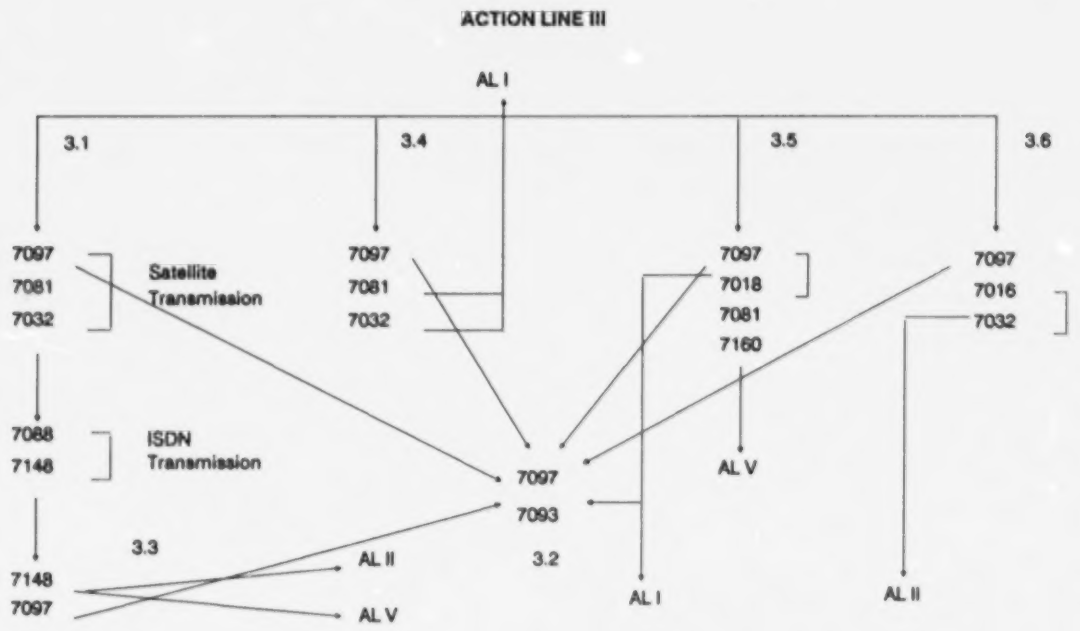


Figure 3.3 : Interaction of AL III with Other Action Lines

LAYER 4 "services"

Services refer to elements which are required by one or more systems in order to function, eg. audio-video conferencing, online information retrieval, generic artificial intelligence applied to tutoring and production services.

LAYER 5 "systems"

Systems refers to high level constructs which may be utilised by one or more environments, examples in the DELTA context being authoring systems, production systems, information systems and interaction systems.

LAYER 6 "environments"

DELTA facilities are embedded in environments designed to fulfil particular purposes. Each environment contains aims, objectives and actors, together with hardware, software, communications and other components which fulfil the environment's purposes, eg. learning environments, providers environment, information resource environments and development environments.

The above model ensures that four important issues can be addressed in a structured and logical manner when specific issues or environments are considered:

- definition of the level of identified components
- identification of common components across model layers
- identification of links at any level of DELTA to other programmes.
- clarification of DELTA in relation to its impact upon learning technology.

Lower levels concern themselves with essential technologies, while the upper levels are more functional, less primitive and concern whole systems, services and environment issues. Above the illustrated layers one could have the enterprise model to reflect concerns of organisations (where in fact some projects would be positioned in part), and above that the market layer, which would be addressed in parts by AL I and V.

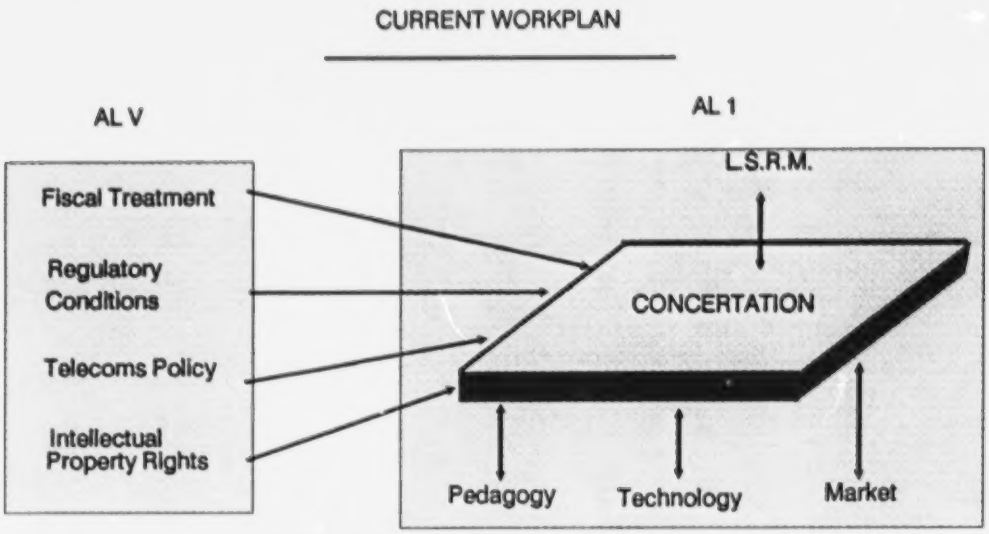


Figure 3.4 : Relationships of AL V and AL I

Not all activity is represented here (Figure 3.2), because it was intended to show the parts relating to core projects, and how they related to other pivotal projects in various tasks. The diagonal lines reflect both contractual and technical dependencies. It can be seen then, for example, that P7072 is a central strategic element in the whole Exploratory Action programme construction.

Figure 3.3 shows the relationship between projects in Action Line III and the other Action Lines where applicable. The tasks are so defined as to ensure a maximum width of experimentation with available transmission media. Relationships to AL I refer to transmission carrying DELTA information as content, and providing input to the analysis of factors affecting the use of technology in learning (AL V).

Some technical work has to be done also under AL III, hence the connection with AL II. As ALIII uses exisiting facilities there is no link with the emerging standards strategy actions.

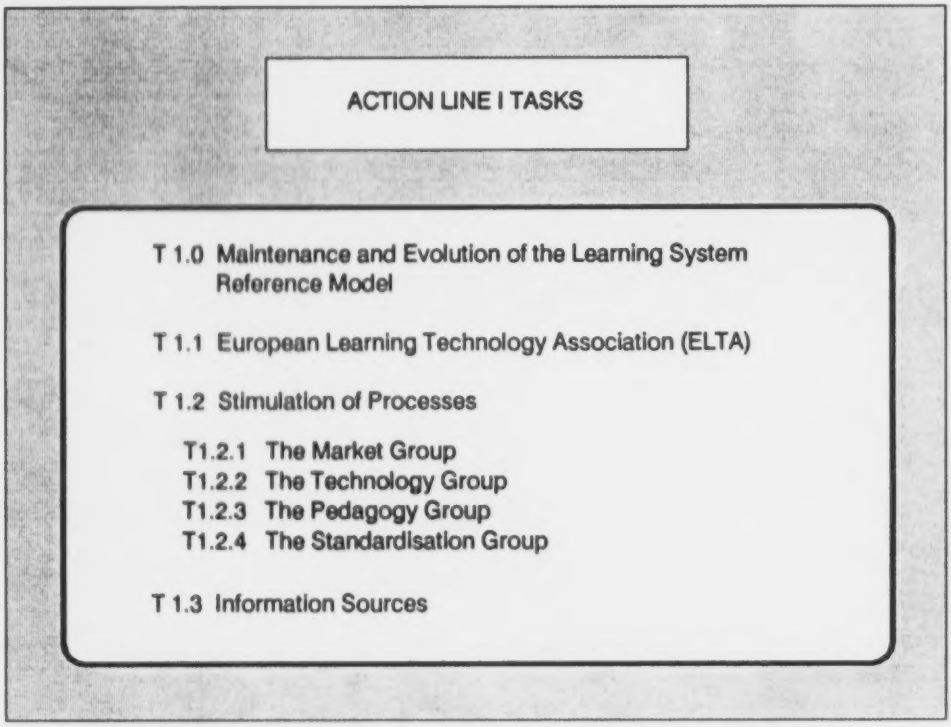
Again it can be seen from this figure that the project P7097 may be considered pivotal to the whole action lines, as it covers the major tasks which have been defined. This project infact is a lead project in innovation in many actions in the action line concertation and management process.

The interwoven structure for example, permits one project to transmit material from another project via a third party carrier (eg Olympus).

Figure 3.4 relates AL V to AL I and the input of each component into the concertation process (see section on Management)

4. ACTION LINES

4.1 Action Line I : Learning Systems Research

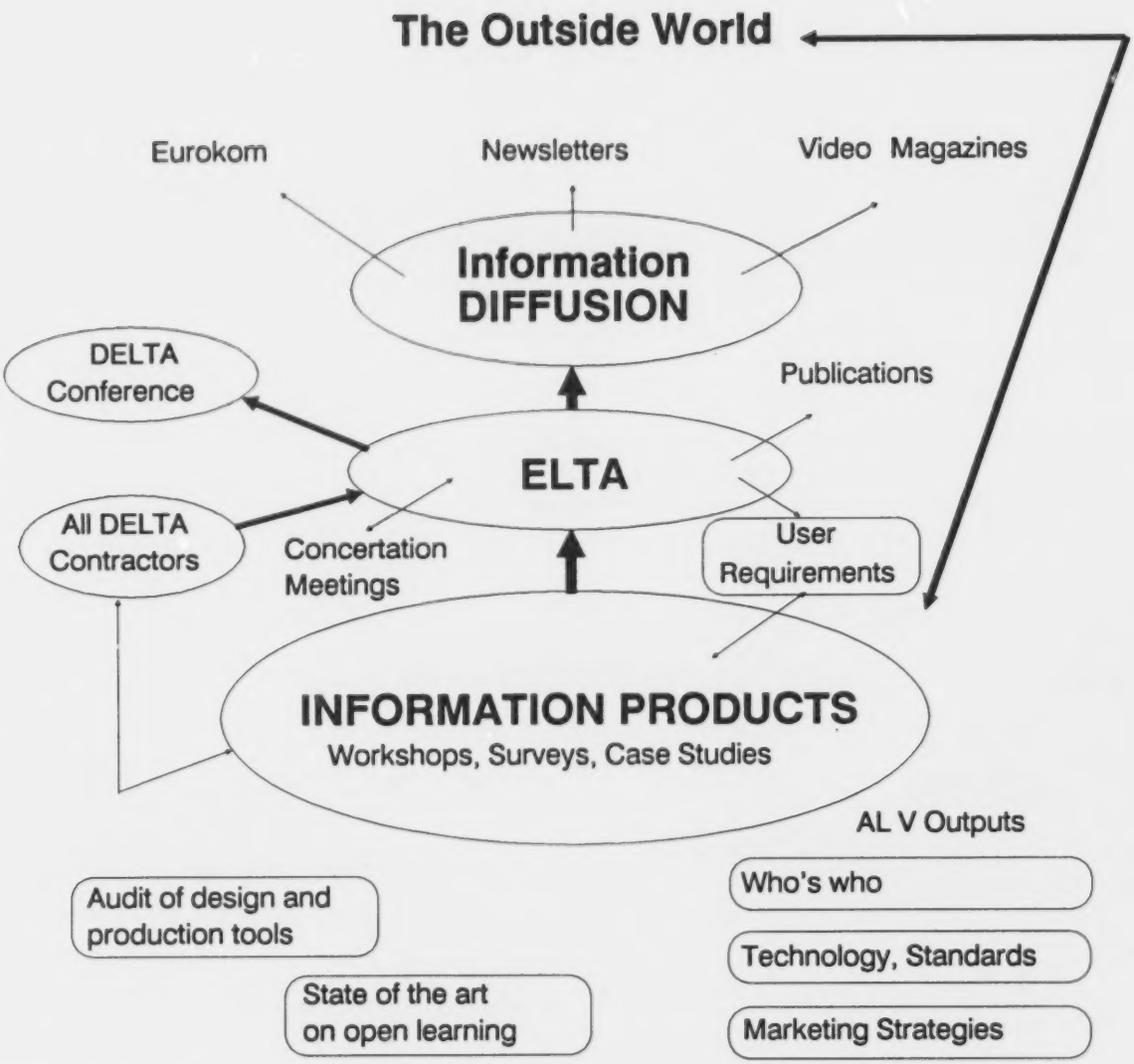

ACTION LINE I TASKS
T 1.0 Maintenance and Evolution of the Learning System Reference Model
T 1.1 European Learning Technology Association (ELTA)
T 1.2 Stimulation of Processes
T1.2.1 The Market Group
T1.2.2 The Technology Group
T1.2.3 The Pedagogy Group
T1.2.4 The Standardisation Group
T 1.3 Information Sources

Objectives

The diversity of European cultures, curricula and languages raises multiple pedagogical requirements which must be matched with the opportunities and options offered by the technology.

There are three main objectives in Action Line I:

- Inform "the outside world" about the output of other DELTA actionlines and create the human and organisational infrastructure to implement the research and development;
- Inform the DELTA contractors about what is going on in the outside world, in order to narrow the gap between today's and future technology/requirements;
- Create an umbrella covering all DELTA projects and world wide developments in state of the art and markets, which must form the basis of a self sustaining infrastructure.



The DELTA Community and Sources

Projects in AL I

P7047/D1023	INTERMAPS: Interactive Multimedia Access Publishing Services for DELTA
P7065/D1025	PRECISE - Promoting and Realising ELTA through Communication & Information Strategies for Europe
P7210/D1005	STARTUP-COMNET - Suppliers for Technological Advanced Requirements through Users Protocols

Project Descriptions

Projects **PRECISE** and **INTERMAPS** will work closely together in order to establish information services and a platform for concertation, **ELTA** (*ELTA : European Learning Technology Association)*. **INTERMAPS** aims to set up a mix of services for the dissemination of information, while **PRECISE** concentrates on the integration and exchange of information in the DELTA domain. A current major objective is a DELTA Conference scheduled for October of 1990. The project is the information stimulation, harmonisation and gathering agency of DELTA. **START-UP COMNET** will address information relevant to the production aspects of learning materials, with an audit of production procedures and tools for multimedia learning.

The **LSRM** is not covered in detail by any of the projects. As a result of the evaluation no project was selected to further develop and maintain the LSRM of the pre-Pilot Study. The inability to develop a comprehensive LSRM reflects the complexity of the domain. A taxonomy, together with the discourse model developed for ALII is useful in guiding the actors through the landscape of the DELTA domain. Projects are able to see their role, and they have interwoven well to form a programme. An independent evaluation of DELTA by contractors showed that the vast majority saw benefits in acting in concert as a programme. No further activity has been explicitly commissioned under T1.0, but other projects are developing their parts of the LSRM for the local or sectorial context.

Results

DELTA has created awareness of the potential and urgency of a combined European approach. Outside of Europe, the approach is seen to be potent and unique. Results in terms of international collaboration, concertation and dissemination of information are being achieved through:

- the setting up of the European Learning Technology Association (ELTA), workshops and conferences;
- organisation of an annual DELTA conference; and seminars on specific topics;
- specific studies in order to identify common needs and technical requirements for open and distance learning;
- the creation of publishing mechanisms and databases on emerging educational technologies, applications, standards and contributions to prototypes and CORDIS databases.

ELTA has been launched by **PRECISE** with a very high response rate from an industrial oriented marketing exercise undertaken by **PRECISE**. ELTA has started operation with the necessary overview of the actors and developments in the complex field of advanced learning technologies (ALT).

PRECISE also organised a well attended International Seminar on Action Line II and IV issues, where working groups and parallel sessions reported that the technical issues raised by DELTA were coming to a concensus amongst the projects, and still in line with market driven objectives. A seminar for AL III is also planned.

The **START-UP Comnet** project has also developed output now available as reports. These focus on "DELTA - **Synthesis, tendencies and orientations**" for actions, a Methodological Framework for Production" Review, and a "**Start-UP Newsletter**". A major seminar with producers was held to collect views and issues for audit of the process.

The **INTERMAPS** project deals with broader information dissemination. They have developed a number of very successful services that enable DELTA developments to be better understood in and outside the immediate technical domain. they include :

- The **ENS - Electronic Newsletter Services** are distributed by the ESPRIT computer conferencing system EuroKom. It consists of a DELTA BULLETIN updated monthly, available to all subscribers, which can be exported to other electronic networks.

- Electronic **DELTA LETTERS**, a mailbox, where users leave information, contributions, comments and questions, which are forwarded to experts for answers and published if of interest to a wider audience.

- An electronic **DELTA FORUM**, accessible only for DELTA contractors, to ensure confidential internal communication.

- **DLT NEWS Newsletter** is a printed newsletter on the 'Development of New Technologies and Learning in Europe' (DLT) published bi-monthly, in **English, French, German; Italian** and **Spanish** in preparation. It contains everyday essential information, with emphasis and variable features tuned for the different language versions. 800 subscribers are already registered. The general technical newsletter is perfectly complemented by the **DLT Interactive Multimedia Journal**, which is of a high scientific standard ensured by an expert "Board of Editors", with three issues a year of about 100 pages, currently in English language with abstracts in other languages. A novel feature is that it includes demonstration of software, prototypes and data on MS-DOS diskettes, and video documentation where necessary.

- The **DELTA Video Magazine** is an audio-visual demonstration of interesting applications, case studies, good practice and actual events related to ALT. The format is of a thematical, homogeneous, 30 minutes core and a 15 minutes "actuality" shell broadcast via the ESA satellite **OLYMPUS**, with extensive additional distribution on video cassettes.

Concertation Meetings are co-planned ahead between **PRECISE** and DelCO to support the information strategies developed by the projects. **PRECISE** also acts as a summariser of the main events of each meeting, and as a distribution centre for deliverable sharing amongst the DELTA contractors on a needs basis.

Complementarity with other projects

There is naturally some complementarity with projects from Action Line III and V, which also seek to raise awareness of modern communications media and its use; and to define the critical factors to create favourable conditions for the use of ALT in general (notably in SME's and regions).

AL III projects use existing and specialist video and film material related to the issues of the day and assess the effectiveness of the broadcasting media as such. This is notably **CAPTIVE** and **Channel-E.**

For **Task T1.1**, additional input is anticipated from :

- **EIOL**; a catalogue of good practices;

- **JANUS** for electronic conferencing and their use in information awareness campaigns;

- **OLEW** workshop for e-mail and conferencing.

For **Task T1.2**, which concerns the stimulation of various processes to create awareness,

- **PRO-DELTA** takes advanced technology into less experienced regions;

- **BIS-FACT** considers the factors that need to be addressed in stimulation actions; and stimulate national focus groups;

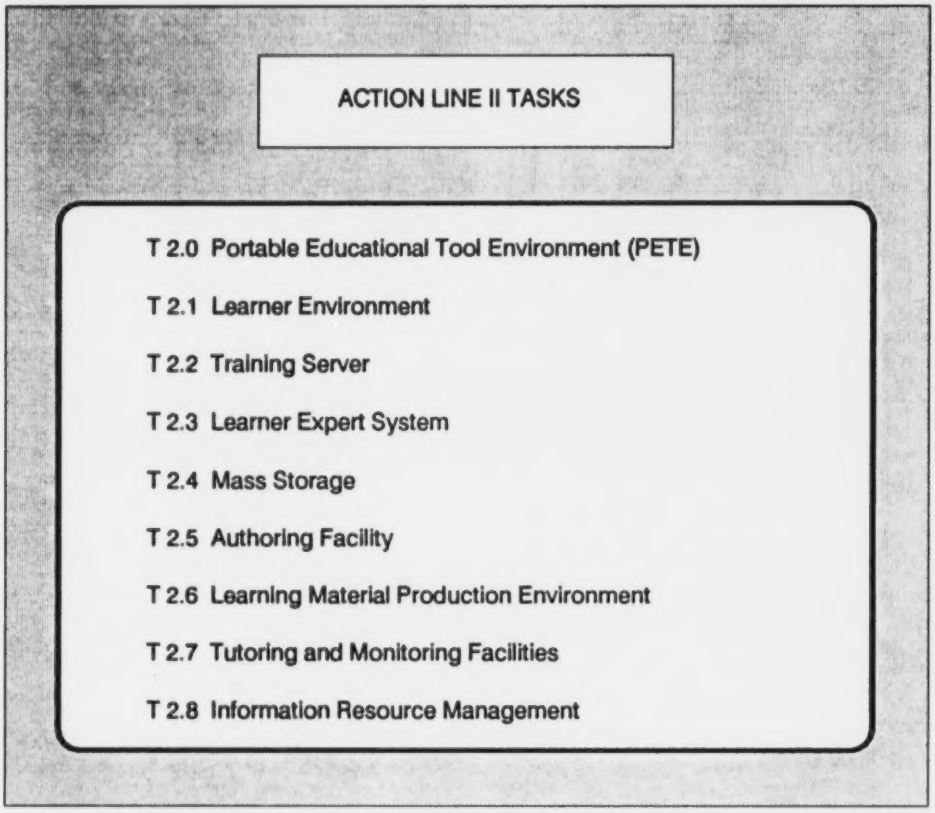
- **OLEW** also raises awareness of the potential of computer conferencing for group learning situations.

- **EX-VOC** applies principles of technology transfer to raise awareness of a technology in less advanced regions for use in vocational training.

For **Task T1.3**, on information sources and their dissemination in and outside the DELTA community, the following projects have complementary activity : **PRO-DELTA, EIOL, BIS-FACT**. The Commission DELTA staff and dissemination activities also contribute extensively to this task.

Overall, the Action Line I projects have succeeded in establishing themselves as the information hub of the Exploratory Action.

4.2 Action Line II : Collaborative Development of Advanced Learning Technology


ACTION LINE II TASKS
T 2.0 Portable Educational Tool Environment (PETE)
T 2.1 Learner Environment
T 2.2 Training Server
T 2.3 Learner Expert System
T 2.4 Mass Storage
T 2.5 Authoring Facility
T 2.6 Learning Material Production Environment
T 2.7 Tutoring and Monitoring Facilities
T 2.8 Information Resource Management

Objectives

Action Line II addresses **'Collaborative Development of Advanced Learning Technology'**. The objective is to complement continuing effort to meet learning needs, and achieve incrementally the design of systems and equipment to support European wide flexible learning. The tasks shown above were defined in the DELTA Workplan.

A pivotal action in Action Line II is the Portable Educational Tool Environment (PETE), which system components should comply with in order to achieve a cost effective, broadly usable tool set and environment for learning systems.

Action Line IV, as a contrast, addresses the issue of **'Interoperability'**. The objectives of AL IV are solely the promotion of interoperability within Learning Technology at an European level, as a first step in a long term strategy to its full achievement. It is a top-down PETE strategy. Action Line IV is complementary to Action Line II. The six tasks of AL IV are closely related to the nine tasks of AL II. The actual links with interoperability were provided by two Action Line IV projects with a top-down approach.

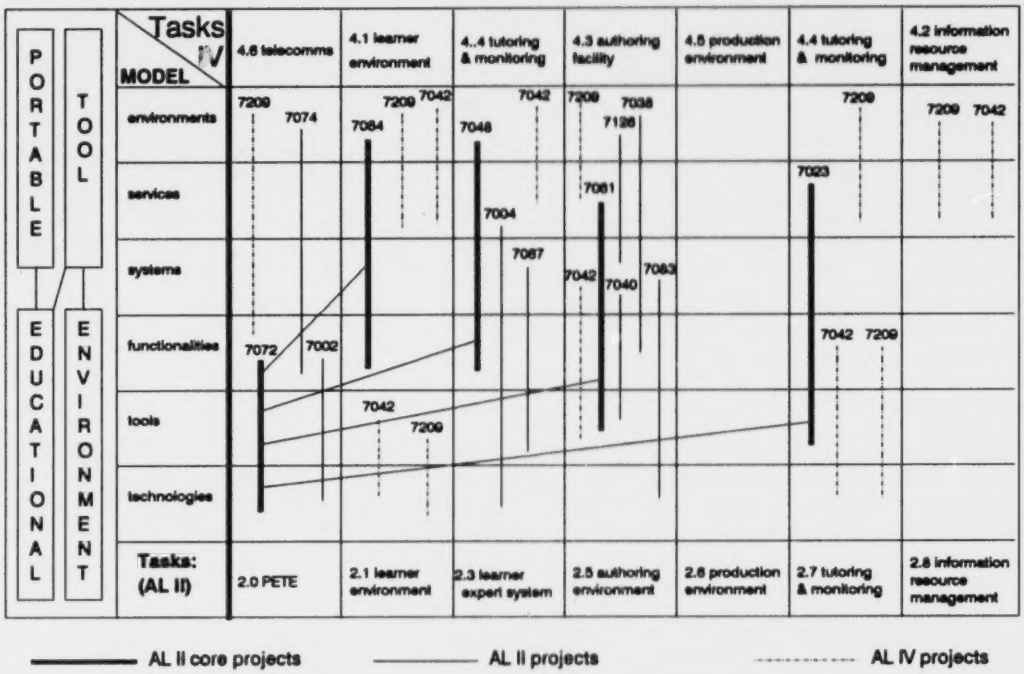


Figure 4.2.1: Action Line II & IV - Project Overview and Core Project Relations

A schematic relationship between the technologies and the projects adopted in AL II and IV can be presented by distributing them diagrammatically on the vertical axes of a layered hierarchical model and a horizontal axis of the different task lines. As discussed in Section 3.2, the hierarchical elements are:

- **technologies:** devices, peripherals, systems software, communications protocols
- **tools and equipment:** hardware and OS software, primitives
- **functionalities:** service accomplishment forming tools
- **services:** system elements such as tools
- **systems:** high level constructs
- **environments:** technical environment of the system.

In Figure 4.2.1, projects are placed at their level broadly in accordance with the hierarchical model. The diagram configures the individual projects into a programme by developing cross contractual links to consolidate technical interdependancies. It tries to visualize the relationships between the different projects and identifies the core or pivotal projects in each task line.

The core projects have characteristics that make them relevant to more than just the area in which they develop their work. PETE, as a central concept of DELTA, gives some basis to the structure other tasks within AL II & IV. Each of the core projects might act as a breadth oriented linkage for the respective task and as an informal upstream link with the core PETE project ASAP. PETE has a special role to play as a central objective for the whole DELTA.

Projects in AL II

P7002/D1026	**EPOS** - European PTT Open Learning Service
P7004/D1016	**NAT*LAB** - NATural Learner Acquisition
P7023/D1020	**TMIE** - Tutoring and Monitoring Intelligent Environment
P7038/D1015	**CAMCE** - Computer Aided Multimedia Courseware Engineering
P7040/D1009	**MATIC** - Multi-Strategy Authoring Toolkit for Intelligent Courseware
P7048/D1008	**ACES** - A Courseware Engineering System
P7061/D1014	**SAFE** - Standard Authoring Facility Environment
P7064/D1004	**ARTISAN** - Intelligent Framework for the Industrial Environment
P7067/D1012	**ESM-BASE** - Author Support for Student Modelling in Multimedia Learning Processes
P7072/D1003	**ASAP** - Animated Specification of a PETE
P7074/D1006	**ESSENTIAL** - European Systems Strategy for the Evolution of New Technologies in Advanced Learning
P7083/D1010	**AAT** - Advanced Authoring Tools
P7126/D1007	**TOSKA** - Tools and Methods for a Sophisticated Knowledge-Based Authoring Environment

Project Descriptions according to Task Line

Task 2.0: Portable Educational Tool Environment - PETE

PETE is a concept that tries to identify the needs for portability by a "bottom up" approach based on the integration of existing functionality and the creation of a software layer to reduce machine architecture dependencies.

ASAP aims to develop a working animated prototype of a Portable Educational Tool Environment. The prototype will be portable across a variety of hardware platform. It will be an object oriented system, on top of the CHORUS distributed operating system and X-Windows, and based on a Lisp implementation.

The project will have input from existing ESPRIT projects **Chameleon (ESPRIT 1228)** and **COCOS (ESPRIT 956)**. The partners are also involved in the core developments of the **Esprit MULTIWORKS** technology integration project in Office and Business Systems.

The project has recently been selected in a competitive evaluation to implement a major component of another project, thus confirming the intercept strategy for a PETE in the domain is beginning to have an effect.

ESSENTIAL and ASAP are complementary to one another but take quite different approaches; the former is hardware & software oriented whilst the latter is more concerned with Human Computer Interaction / Man Machine Interface (HCI/MMI) and interfacing the PETE toolset to the community of users in a framework. This project aims to develop a reference model for PETE (not unlike that required in a LSRM), through requirements modelling, defining technology scenarios and through functional specifications. This work builds on the **BEST** project in RACE, and ESPRIT work in **P385 HUFIT**. The ESSENTIAL coordinating contractor (MARI) is also a partner in **LEAST (P7042)** in Action line IV which will act as a direct II-IV concertative link. The **OSIRIS (P7209)** presence in Action line IV, Task 4.6 (Telecommunications) will strengthen this.

EPOS adds the technical and strategic expertise and experience of four European PTTs (German, Italian, Spanish and Swedish) in CBT training and communications. The project covers some 16 subcontractors and two other proposals, and will attempt to undertake the following main tasks :

- a complete implementation of an environment, taking state of the art developments, simulating communications, and testing the acceptability by internal testing and with leading edge users;
- influence the development of standards for CBT in the PTT domain, by directing effort at the CBT CEPT standard bodies responsible for setting such standards;

- create a strategic movement in Europe by opening the project developments to all PTTs who can contribute and benefit from the technology transfer. This political step has created enourmous interest, and requests for participation from outside Europe already.

EPOS is the first project whose partners have made a major commitment to the domain ahead of any possible continuation of DELTA. The major actors recognise the need for this action to meet their own internal demands, and to offer a service on new ISDN capabilities.

Task 2.1: Learner Environment

ARTISAN focuses their work in two directions; development of a general industrial training model and training configurations derived from it; and the tools and hardware support for design of a human centered training workstation. The project aims to specify a learner station that meets the requirements for learners in the area of Computer-Aided Manufacturing (CAM or CIM), Production and Design.

Any DELTA learner workstation is also to be considered as a host for activities in task 2.3 (Learner Expert System) and task 2.5 (Authoring Environment), so that commonality of hardware and system software across activities will be investigated. Links between **ACES** in 2.3 and **SAFE** in 2.5 are established.

Task 2.2: Training Server

Task 2.2 is not explicitly covered by one single project. The functionalities of a training server are covered as an integral part of the different systems addressed by AL II projects. Especially **TMIE** and **ARTISAN** will specify required functionalities.

Task 2.3: Learner System Expert

NAT•LAB addresses the issue of a methodology for (semi)automatic knowledge acquisition for learner modeling and aims to design and develop the shell of a knowledge-based system to represent the characteristics of a learner at different stages of understanding during the learning process.

The system will include advanced tools such as overlay models of learners versus belief representation and reasoning under multiple viewpoints; tutor-driven dialogues, guided discovery learning and mixed initiative dialogues; some machine learning and the automatic construction of deviating models of the learner as a result of experimental data. Prototypes have been built and are being experimented with, while porting them to the widest possible hardware platform using native European Lisp environments ensures industrial relevance. A special effort will be made in industrialisation.

ACES will specify and implement a prototype of 'a learner expert' giving advice on the curriculum level, course level and interaction level. The learner expert will be modelled as an intelligent interaction management system that supports different levels of services, ranging from simple administrative support, to advanced forms of user modelling suitable for misconception diagnosis. It will take input from experience with ESPRIT "**Eurohelp**" (ESPRIT reference No. 280).

Task 2.4: Mass Storage

There were no major proposals received in the area of mass storage. This suggests that it is a market driven issue independant of the DELTA application domain, and as such should be a function of industry. However the application of new and advanced technology for mass storage is covered in several projects. ESPRIT is also supporting development work that progresses the entry of optical storage into the main stream of computing storage devices. Market surveys show that 25% of optical storage is used for educational applications. **SAFE** addresses issues of CD storage for standards and for OS-ID design

Task 2.5: Authoring Facility

CAMCE aims to specify a distributed environment to develop multimedia courseware suitable for different instructional strategies and technologies. The environment specifications will be based on a multimedia courseware development model. It will incorporate the design of a multimedia database to store all types of information generated during the development process (text, graphics, animation, pictures, film/video, audio). Furthermore the project will specify a satellite network, interconnected with ISDN, to support distributed development of multimedia courseware.

MATIC specifies a fully modular suite of software tools with an open architecture. The tools will support different didactic strategies (such as multi-media computer based training and intelligent tutoring systems), domain modelling and learner modelling, as well as multimedia production and networking. The tools will themselves be intelligent and the formal specifications will be fully portable.

The tools will allow the building of a domain model in two parts: a re-usable core "concept model", and multimedia attachments to the concept model that can easily be re-tailored in another (natural) European language.

SAFE aims at the definition of a Open System for Instructional Design (OS-ID) and the functional design of authoring facilities to be embedded in this OS-ID. In the Exploratory Action the project is limited to first steps towards **standardisation** of facilities and data-structures and to defining how state-of-the-art Information Technology and Instructional Technology can be **merged** to develop sophisticated authoring facilities. The project also considers issues addressing task 2.4, Mass Storage.

The project will investigate in detail development requirements of simulation-based and hypermedia-based learning materials.

Furthermore several generic aspects of the authoring process (e.g. subject matter analysis, courseware engineering, design databases, user interfaces) will be addressed and the project will investigate how these aspects of authoring can be supported by sophisticated tools.

AAT seeks to build a domain independent authoring environment compatible both with traditional CBT methods and more advanced AI methods (Extended CAL systems: i.e. systems which incorporate simple Artificial intelligence techniques into CAL systems and Intelligent Computer Aided Instruction systems).

A key feature of the approach is to support upward compatibility: the system can therefore be viewed as providing a smooth transition from traditional to advanced authoring environments.

TOSKA deals with the concept definition of a knowledge based 'Universal Teaching Engine' that is able to support the authoring process under varying constraints established through different content domains, learner requirements, and even technical up- and downgrade according to the peripheral devices available in a specific environment.

The knowledge-based system will make use of various kinds of knowledge about content independent conditions of teaching and learning, such as:

- the structure of the instructional contents in terms of goal hierarchies;
- tutoring, presentation and management strategies;
- learner modelling in order to adapt the instructional system reactions to specific cognitive and motivational prerequisites and individual learning strategies.

Task 2.6: Production Environment

There is no explict project. However, **TMIE** has a strong emphasis on the production process in terms of production languages. **EPOS** develops an implementation of this domain, **START-UP - COMNET** (P7210 in AL I) considers practical usage of an existing facility while **CAMCE** looks at the tools and technology requirements.

Task 2.7: Tutoring & Monitoring Facilities

TMIE is focused at the production process in terms of an standard production language and links with an intelligent tutoring and monitoring environment. The system will support local and distance tutor-learner and learner-learner interaction.

The three main systems to be specified are a production system, a tutoring system, and a monitoring system.

Task 2.8: Information Resource Management

ESM-BASE emphasises the issues of multi-media IRM. It investigates the impact of use of it as an educational resource, its effect upon model of the learner and its role in the learning and authoring processes. The project aims at a conceptual model for a DBLM and associated user interface with student modelling for navigation strategies.

Projects **TMIE , CAMCE, SAFE, ASAP and TOSKA** are also related to the information resource management issue.

Results

Action line II is the only area where major technical work is done, and it must address all aspects of advanced learning systems technology.

Portability of material and tools, environments and systems view

On top of existing and emerging European technologies the requirements and opportunities of a Portable Educational Tool Environment (PETE) are being investigated. PETE results in a hardware independent layer or platform, which enables the development, distribution and use of tools and educational software for a range of vendor equipment. Several industrial standard technologies (eg. Hypertext, distributed UNIX, X-Windows, a European Common Lisp environment) will be incorporated and harnessed to the educational needs. Major suppliers of educational software and production environments committed themselves to build incrementally on results achieved on PETE. Strong long term involvement of four PTT's - in **EPOS** - indicates the momentum of this development. Projects requiring software for their stage of development have begun using the basic PETE harness.

PETE is taking shape with added functionality now being fed through by other projects. The largest DELTA project, **EPOS**, has competitively selected the deep technical PETE project, **ASAP**, for a major feasibility study for a long term implementation. **ESSENTIAL** is developing the top-down strategy based on its Enterprise Modelling and consolidating the link with the ESPRIT **PCTE** work. All projects are contributing to a major paper planned on PETE for mid-1990.

In Mass Storage, **SAFE** is raising awareness of CD storage technology and the requirements for standards and conventions in this rapidly changing environment. The advent of the NeXT machine worldwide has ensured the marketability of removable erasable writeable optical media, and the project is spreading its developments to other programmes also.

Supporting the Learner

Learner Expert System work is progressing better than expected. **NAT•LAB** has developed prototypes (ALICE, ET, BOUSTENEN, TROTELC) but also two advances (LUGA - a unification grammar, GTE - an environment with emphasis on representation of human expertise). Major industrial players (the largest European market actor in IT and the largest auto manufacturer in Southern Europe) wish to join project at the half way stage in order to adopt the technology.

ACES is developing the early advances in ESPRIT further in dialogue management and foreign language use and teaching. Curricula support and courseware database browers also support the student to improve his decision making process.

Authoring and Production Environment

Authoring systems and languages are lacking flexibility and address only limited types of vendor hardware. Production of learning material is overall limited to traditional types of courseware, is not cost effective and is not serving international markets. Identified areas of advance are:

- authoring environments supporting multiple learning strategies and ITS;
- intelligent tools supporting knowledge acquisition and domain modelling;
- powerful graphical editors and scripting tools;
- methodologies and facilities for rapid prototyping and testing;
- distributed authoring facilities supporting the use of existing materials;
- general applicable design and specification methodologies.

Authoring and production facilities have perhaps seen the largest number of developments in the various projects:

SAFE is developing a major strategic move with some approaches to standardisation in this domain, based on Opens System for Instructional Design (OS-ID), coordinated with PETE. Hypermedia and simulation will be areas where their developments are concentrated.

CAMCE is developing a multimedia design facility which will be tested with outputs from COMETT, ESPRIT and RACE.

MATIC has reached consensus on high level interfaces and domain modelling issues for ITS and now seeks to link into a communications environment.

AAT has built upon its ORGUE work to develop the worlds first multi-media ITS with integrated authoring tools, DOMINIE, supporting multiple authoring methodologies to produce SHIVA. Some of this work is now being exploited already commercially and being ported to ESPRIT projects.

TOSKA is progressing in developing intelligent authoring systems based on efforts to reduce authoring and production costs and integrating advances on the student modelling. The work relies heavily on prototyping and experimental feedback in an industrial environment with leading edge users.

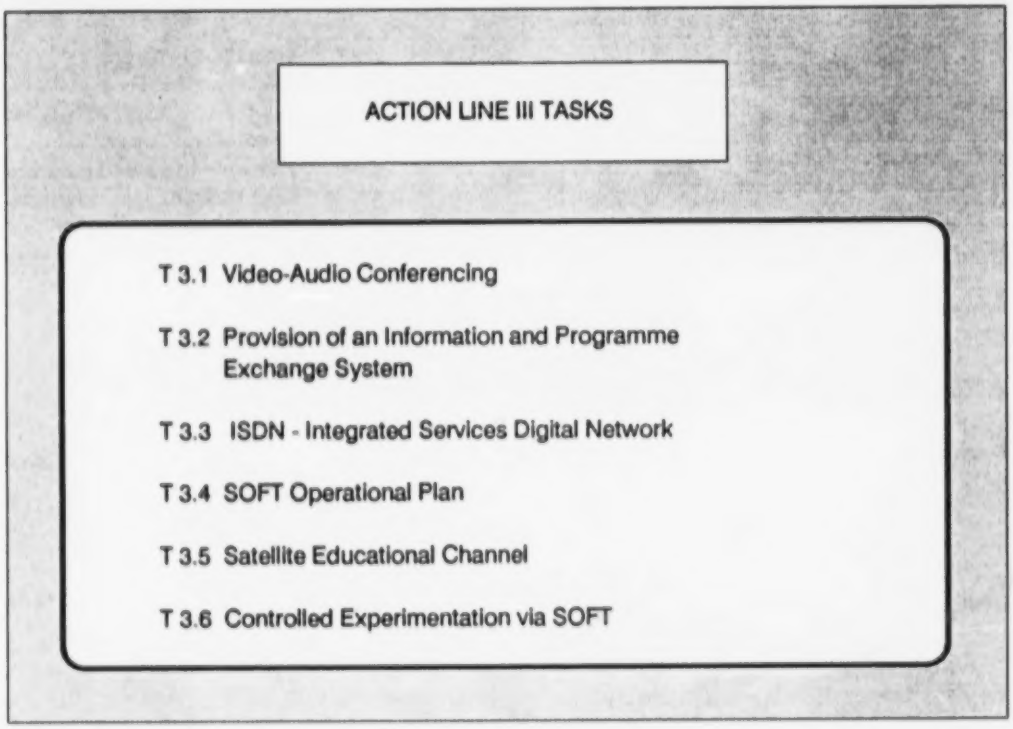
Information Access, Tutoring and Monitoring

Learning materials all have the need for access to information on which learning is based, and some form of monitoring shell, so that the student may self-assess his progress, or an external tutor can monitor in some form. Various individual projects supply support for these functions by considerations of communication interfaces and interworking.

ESM-BASE considers the other aspect of continuous support required by learning systems - access to multimedia databases. Its objective is to support navigation strategies through large mixed media information resources, to harness these efficiently to the learning objective. It will develop a shell on top of a learning system that enables this to take place, with a facility for building up semifabricates of learning units which may be reused. A prototype has been built, and a tool for building multi-media learning units is being tested.

TMIE already covers tutoring and monitoring by design at the production environment level. Work is progressing on the prototype environment that will provide support tools for identified support function, with an emphasis on cost benefit analysis.

4.3 Action Line III : Testing and Validation of Communications and of Satellite-based Open Facility for Testing


ACTION LINE III TASKS
T 3.1 Video-Audio Conferencing
T 3.2 Provision of an Information and Programme Exchange System
T 3.3 ISDN - Integrated Services Digital Network
T 3.4 SOFT Operational Plan
T 3.5 Satellite Educational Channel
T 3.6 Controlled Experimentation via SOFT

Objectives

The aim of Action Line III is to take full and early advantage, in the *interest of learning*, of advances in telecommunications.

Its objectives are:

- To analyse the integrated communications and operational organisation support facilities requirements of European learning in terms of the new terrestrial and satellite transmission capacity about to become available;
- To ensure that these facilities can be effectively harnessed to the learning function.

Projects address all the tasks of Action Line III, which is centred above all on two important telecomms facilities: ISDN or Terrestrial networks and Satellite networks, including Video-Audio Conferencing.

Action Line III is incremental in its approach, building on ISDN as a preparation for the introduction of IBC in the year 2000.

Projects in AL III

P7016/D1026	**SATDOC** - A Satellite Mediated Controlled Experiment for Continuing Education and Monitoring for Doctors
P7032/D1028	**OLEW** - Open Learning Experimental Workshop
P7081	**JANUS** - Joint Academic Network Using Satellite for European Distance Education and Training
P7088/D1011	**LAT** - Learning by Advanced Telecommunications
P7097/D1013	**CAPTIVE** - Collaborative Authoring Production and Transmission of Interactive Video for Education
P7148/D1021	**OLE** - Organisational Learning Enterprise
P7160/D1022	**CHANNEL E**: Development of an Educational and Training Satellite Service

The main objective of almost all the projects is to act as a testbed for communications developments, exploring different contexts or addressing particular target groups. They deal with:

- delivering multi-media materials;
- distributed authoring and production;
- delivering remote seminars with interaction;
- use of multilingual broadcasting;
- handling very large databases.

Project Descriptions

Mixed Communications Experimentation

OLEW aims at implementing an Open Learning Experimental Workshop of IT&T, whose main goal is the creation of a permanent meeting point for different actors, both producers and users. In view of a first experimental training activity based on an intensive use of advanced information technologies, the topics which will be dealt with are the following:

- Computer conferencing
- Televideo conferencing
- Direct Broadcasting by Satellite (DBS)
- Techniques for redundancy reduction in television images
- Implementation of suitably equipped and organized teaching classroom

CAPTIVE will establish a testbed for a communication network involving broad-band cable, DBS and ISDN. The network is also for the development and distribution of educational video material and applications. The project will set up a multi-media data network (using cable networks and ISDN simulation) for access to knowledge bases. To complement this, the project will experiment with satellite transmission and identify techniques and hardware requirements for remote interaction over networks and transfer of learning materials. The will built on the results of the Esprit projects: **MIAC** (audio conferencing) and **PICA** (photovideotex standards).

JANUS is a feasibility study for a private voice and data network via satellite to link up European institutions producing distance teaching and training materials for delivery on a European-wide basis. The study will address:

- specifications and costs for narrow-band, two-way earth stations which will allow two-way voice communication between any two sites, audio conferencing across all sites , electronic mail, computer conference facilities for transfer of draft teaching texts and an experimental video-conferencing facility;
- specifications of an easy to use front-end for terminals and workstations;
- regulatory aspects referring to community wide use of voice and data networks.

OLE will experiment with multi-media on-the-job training courses through terrestial networks and the use of satellite. By simulating ISDN, a link between Denmark and Portugal will be established. The project will specify the facilities required and develop guide-lines for the use of open and distance learning.

Satellite Experimentation

DELTA uses the resources of two satellites principally; ASTRA through **Channel-E**; and Olympus, by individual projects scheduled through the EuroStep foundation.

SATDOC will experiment on the use of multiple language learning material. Test material will be made in **En, Fr, D, E, Nl, P, It and Dk** and broadcast to different users' centres, using a newly developed information centre. An electronic link back via a modem will be developed to ensure the monitoring of the learning process. The experiment aims to investigate the costs of material for professional persons in training in English, in producers "own language" subtitles and in the learner's own language. The project makes use of an assessment methodology based on a substantial database with users' characteristics, offering a unifying thread for validation of learning experiments.

The aim of **CHANNEL E** is to broadcast four series of programmes using the Astra satellite in order to investigate requirements for an initiative for a European Educational Channel covering multiple language broadcasting, distributing database services through satellite and scheduling issues. Third party programmes are also being solicited and broadcast. This way existing sources of material are established, and experience about educational DBS broadcasting increased, especially in multi-language broadcasting.

LAT will formulate requirements and options for videoconferences in education. For various training groups the project will identify how interaction between teacher and learners can be established, which pedagogical methods are compatible with hard/software, what systems requirements can be identified and how transmission of on-the-spot material can be achieved.

Results

Stimulation of an European market for open and distance depends strongly on facilities to distribute information and learning materials and pre-supposes the availability of communication links. The use of satellites require extensive experimentation and harnessing technology to educational needs. Results are emerging on:

- the identification of infrastructures and facilities for the application of telecommunications in education, including ISDN and DBS;
- feasibility studies to establish a European Educational network;
- testbeds showing the effectiveness of introducing audio-video conferences in learning, pedagogical methods and adequate transmission widths;
- experiments identifying the requirements for distributed authoring and production;

LAT has established itself as an innovative project seeking out new ways of using group communications to raise awareness levels in areas of community wide interest. Five main experiments have involved different user communities, as well as advanced wire networks, with overlaps in the RACE programme.

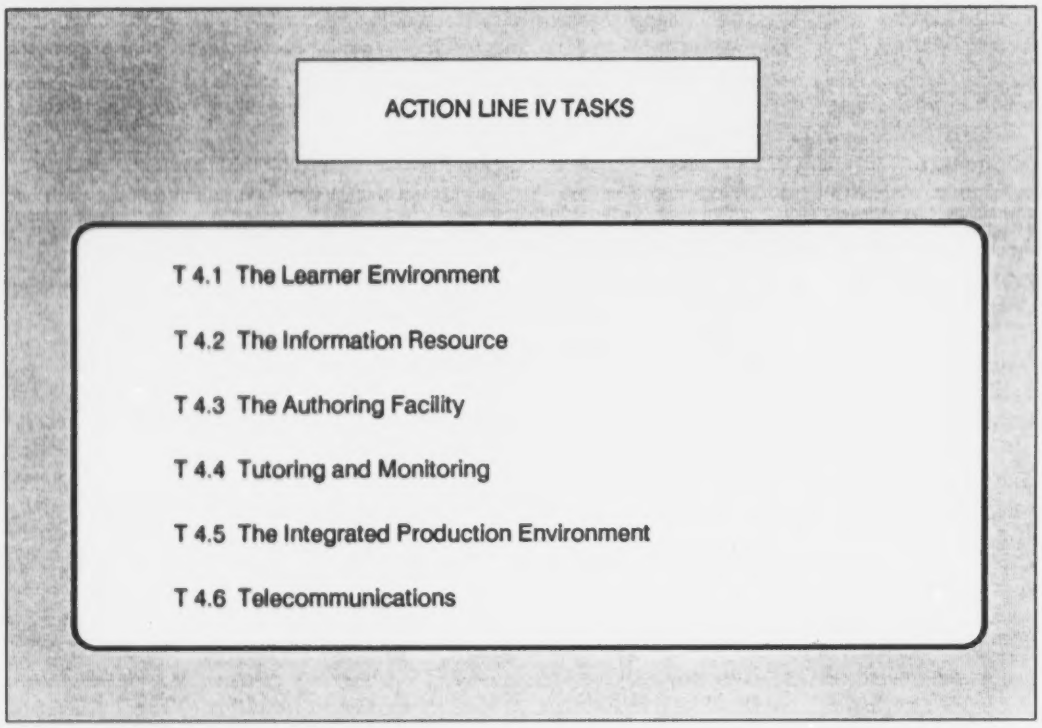
CAPTIVE is experimenting with satellite programmes and other communication networks to access and update knowledge bases. Work on inter-cultural issues is being disseminated with great interest to other DELTA projects. Video production and transmission techniques are being developed for general use, together with integrated interaction, which is considered to be essential in good "human oriented" learning systems. The experiments cover LIVENET and the Olympus satellites.

OLE is using freeze frame X25 connections and satellites to undertake technology transfer experimentation between Denmark and Portugal, and thus identify cross-cultural and non technical barriers to distance training and training support

Channel-E is developing a catalytic role, soliciting programmes from third parties and scheduling them over the Astra satellite, for common assessment. Material includes cultural social and language issues, including minority cultural aspects.

SATDOC is very successfully experimenting with coded confidential medical images using the unique PIPA-Crypt device, which allows confidentiality on patient identification to be maintained, and for example, permits exchange of information on drug testing without fear of public liability.

4.4 Action Line IV : Interoperability


ACTION LINE IV TASKS
T 4.1 The Learner Environment
T 4.2 The Information Resource
T 4.3 The Authoring Facility
T 4.4 Tutoring and Monitoring
T 4.5 The Integrated Production Environment
T 4.6 Telecommunications

Objectives

Action Line IV deals with interoperability. This is the ability for two or more (or one replicated) pieces of software to operate interchangeably, either as components of a larger system on different hardware in distributed mode, or to replace each other and accomplish similar goals by mutual substitution. The projects attempt to blend market forces with the development of emerging standards to ensure optimum acceptability and relevance of emerging developments.

The objectives are :

- to ensure that standards developments on various media converge;
- to identify and promote relevant work where currently none exists;
- to give specific expert advice on conventions and standards;
- to indicate the type of functionality flexible learning is likely to impose on emerging standards;
- to promote within the ALT community developments in standards and emerging conventions;
- to promote and develop specific standards as and when these may emerge from related activities, and to ensure their representation in relevant world fora.

Projects in AL IV

P7042/D1001	**LEAST** - Learning Systems Standardisation
P7209/D1002	**OSIRIS** - Optimum Standards for Successful Market Integration of Multimedia On-Line Services

AL IV is a long range strategic activity where the emergence of standards must be strongly supported by industry. The objectives of the action lines conform wholly to the standards policy directive of the Community in all the relevant sectors.

The standards in the domain of DELTA are widely dispersed however. They cover physical and logical media, production in distributed systems, access to data and knowledge bases of widely different scopes; operating systems and networking / communications standards from physical wires, optical or electrical, to direct broadcasting satellites. A wider appreciation of the individual standards is therefore important, they are separately discussed in Section 6.

As noted before, Action Line IV constitutes of a top down approach towards PETE and is closely related to Action Line II and Action Line III. Note that the task structure in Action Line IV follows closely that of Action Line II.:

Project Descriptions

Both projects in Action Line IV cover all the tasks mentioned above. **OSIRIS** is very much market and socio-economic oriented, whereas **LEAST** takes a more technical approach.

LEAST- LEArning systems STandardization

The overall objective of the **LEAST** project is to carry out recommendations and proposals for the selection of standards, on top of existing and emerging technology standards, for the representation and exchange of information between the different learning sub-systems.

In that framework, the three main technological areas of concern to the project are:

- selection of standards for the representation and exchange of multimedia information both of basic information (such as graphic, image, sound, video sequences, etc) and for structured information (such as courseware, script, etc);
- recommendations on adaptive and general applicable user interfaces;
- selection of standards for telecommunication protocols for the exchange of applications.

LEAST seeks to define the architecture of a learning system. The project will develop functional requirements from the point of view of the different actors involved in a learning system, and conduct a state of the art review of existing relevant standards. Proposals will be made to fill the knowledge gaps identified.

OSIRIS - Optimum Standards for successful market IntegRation of multI-media on-line Services

OSIRIS combines several disciplines (computer science, cognitive science, sociology and economics), to examine the influences between markets and standards for Advanced Learning Technology. In this way, the project tries to arrive at an ideal type model for the delivering of positive statements on the willingness of organisations to invest in Advanced Learning Technologies, making comparisons with the non-European main competitors.

OSIRIS uses a two phase approach:

In phase one, **OSIRIS** will gather an extensive knowledge of Open and Distant Learning by studying the current environment of ALT covering technical, sociological, psychological and economical factors, and by studying the current situation of training in a significant number of European companies. Phase one will be concluded by the construction of a Model of Effective Learning in order to generate statements of hypothetical standards.

Phase two will validate these standards by testing them with training users and providers in industry and commerce. These standards will drive the development of ideal/typical functional and technical specifications for ALT. Recommendations for a cost-effective learning system and organisation will then be drawn with practical aims.

It is also intended to prospect and to assess standardisation criteria for Advanced Learning Technologies environments at every level using the ISO/OSI framework. The human factors aspects of this project are based on and continue (in the DELTA orientation) the human factors work developed in the ESPRIT project **P385 (HUFIT)** and other work following on from that work.

Furthermore the project aims to develop a set of system requirements. The emphasis is placed on the technical and industrial as well as the commercial and social aspects of the design and exploitation of multimedia servers.

The project will organise a Forum whose main purpose is to provide a platform for exchanging experiences and problem solving concepts, to discuss possible co-operation between large industrial and business companies, and to create a connection to ELTA for information dissemination and for further integration of the outcomes.

OSIRIS is a therefore a strategic study which will examine technical standards and human competences in relation to Advanced Learning technology (ALT) in real market situations. It will critically examine possible standards for an open learning environment in Europe, and will make positive recommendations on future standards.

Other projects related to AL IV

Other projects also touch the area of standards and will have impact in the international sphere as a result of the work in the related areas, though their emphasis may be in other domains of DELTA :

SAFE - Standard Authoring Facility Environment.

The project **SAFE** has initiated the pan-European development of a coherent and flexible framework to harness emerging European Learning Technology in respect of facilities for developing open learning material. The current project in the Exploratory Action concentrates on first steps towards standardisation of facilities and data structures and to defining how state-of-the-art Information Technology and Instructional Technology can be merged to develop sophisticated authoring facilities. The main results will be the definition of an Open System for Instructional Development (OS-ID) and functional designs of authoring facilities to embed in it.

Two potentially important types of open learning material are being investigated in detail (simulation-based and hypermedia-based); together with other aspects of the authoring process like subject matter analysis, courseware engineering, design databases, user interfaces.

Emerging standards in the area of multimedia technology (notably CD-I and CD-ROM/XA) and software engineering environments (as addressed by the ESPRIT project **"Atmosphere"**) are taken into account, while input will be given to standardisation on authoring environments, hypermedia and simulation-based systems.

EPOS - European PTT Open System for Learning

This project is the largest in DELTA, and it aims to make a full technical implementation of a flexible learning system. It is extensively reported on in the description of Action Line II. However, what is most relevant to Action Line IV is that the members of the consortia also represent a major movement in the CCITT standards committees for Computer Based Training. Therefore any experience gathered via the project will feed into the standards process quite rapidly, and influence the major carriers directly.

Results

Standardisation and interoperability is a pre-requisite for an effective and economical European open learning market. Standardisation effort should be both technology and market driven. On top of existing and emerging technology standards and conventions (eg. OSI, X-Windows, Unix), specific standards and conventions for educational technology are being identified and recommended, see panel below:

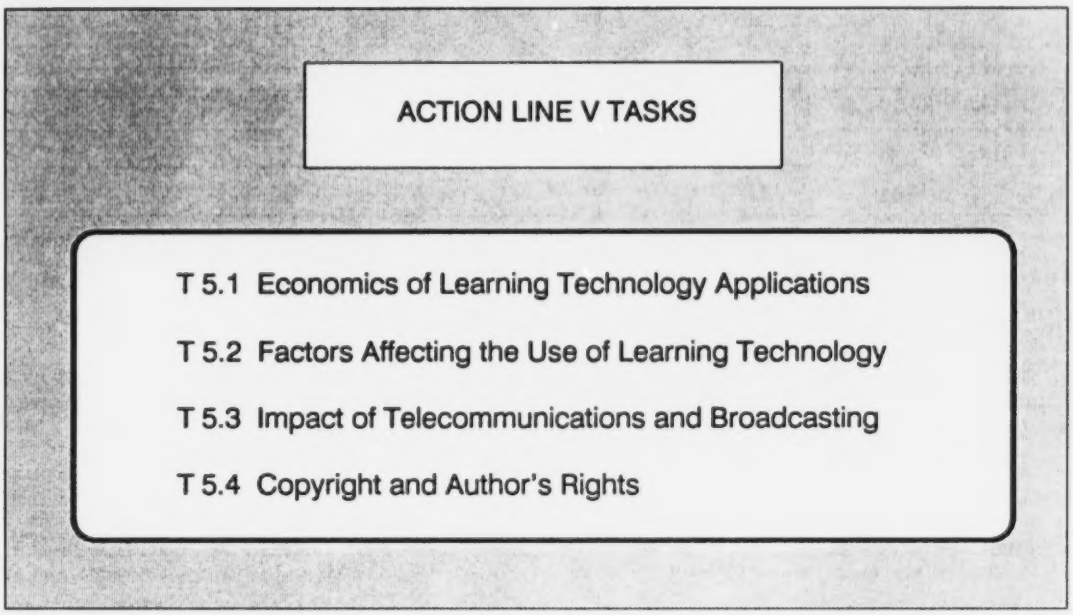
The projects described above are all well on the way to meeting their objectives. **PETE** projects will demonstrate **X-Windows**, distributed UNIX and an integrated development environment with **Postscript**. The infrastructure actions will offer a forum for the various conventions and standards to be discussed and consensus reached. The **EPOS** project is seeking extended collaboration in the formal CBT standardisation process with all other european PTT's that wish to be part of the concensus formation process. Regular information flow to **ETSI** and **CEN/CENELEC** is encouraged.

The other DELTA contractors consider this action line to be a sound market driven approach to the problem, and actively engage in supporting the work with their own inputs.

Results from AL IV Projects

- identification of common and standardised systems architecture for authoring and learning environments;
- interfacing and communication protocols for telecommunication applications in education;
- recommendations on adaptive and general applicable user interfaces and presentation models;
- identification of criteria for quality assessment of learning materials and learner environments;
- recommendation of standardised design methodologies and protocols supporting the transfer of learning materials.

4.5 Action Line V : Promotion of Favourable Conditions


ACTION LINE V TASKS
T 5.1 Economics of Learning Technology Applications
T 5.2 Factors Affecting the Use of Learning Technology
T 5.3 Impact of Telecommunications and Broadcasting
T 5.4 Copyright and Author's Rights

Objectives

Action Line V is complementary to Action Line I, supplying the information dissemination infrastructure a number of surveys, specific studies and case histories to orient the actors.

The key objectives of Action Line V are as follows :

- the Economics of Learning Technology Applications (cost/benefit, markets, options and recommendations).
- Factors affecting the use of Advanced Learning Technology (eg. regulatory factors in telecommunications, broadcasting, including organisational and cultural aspects).
- Impact of Telecommunications and Broadcasting with respect to tariffs, certification etc.
- Copyright and Authors' Rights, protection of investment, better access etc.

Projects in AL V

P7026/D1019	PRO-DELTA Portuguese Research on DELTA
P7053/D1017	EIOL European Infrastructure for Open Learning
P7113/D1024	EX-VOC Expert System Contribution to Vocational Training
P7122/D1018	ETEE-Educational Technologies for European Enterprises
P7162	BIS-FACT- Distance Learning, Inhibiting Factors and the Creation of a Favourable Environment

Project Descriptions

The projects focus mainly on case studies for the economic and structural factors affecting use of IT&T in education. They are input to the ELTA forum of Action Line I, as well as helping maintain the direction of DELTA with respect to market requirements.

PRO-DELTA concentrates on requirements and options for open and distance learning for special regions (such as Portugal and France).

Case studies of good practice and an analysis of tariff policies in relation to distance learning will be conducted by **EIOL**. Case studies of good practice and a survey of existing networks will help assess actual and perceived and future demand for ALT. PTT tariffing and quality control is addressed also.

ETEE will focus on the necessary (favourable) conditions for the development of educational technologies for training purposes in small and medium sized companies.

EX-VOC will assess the opportunities and roles of expert systems in vocational training and also the role of government and agencies.

A detailed research investigation of the experiences of suppliers and users (existing and potential) of distance and open learning systems will be executed by **BIS-FACT**. The project will take in account the experiences in the USA. The research will be based on a mixture face-to-face and telephone interviews and forum discussions.

Results

Research is being applied on the identification of user needs and options for supply by industry. Special emphasis is being put on regional and sectorial (SMEs) requirements.

Case Studies of Good Practice

Fifteen examples of good practice in Open Learning are analysed by **EIOL**. **EXVOC** reports on the problems of encapsulation and transportation / transfer of knowledge in AI shells between different public and private sector scenarios in different member states with variable skills in the technology.

BIS-FACT uses national focus groups and interviews with leading decision makers to establish market practices and forces, including analysing the US situation.

Structural Issues

PRO-DELTA reports on issues affecting the use of leading edge technology in small isolated segmented markets, and the advantages of satellite educational broadcasting to reach them. General market estimates are attempted. **EXVOC** considers the specific use of expert systems technology in vocational training.

BIS-FACT identifies the current barriers to the penetration of ALT into the market place, in sector and national segmentation.

Certification, Policy and Tariffing

Distance learning tariff issues are compared and a model for certification for quality and user protection is developed by **EIOL**. **EXVOC** identifies activities for public bodies in the use of ALT (Expert Systems in this case) in vocational training.

Policy isues hindering open and distance learning penetration are identified in **EIOL**.

Small Medium Enterprises (SME)

SMEs problems in the use of ALT are specifically addressed by **ETEE**, by developing a regional model for improved access to flexible learning offerings with low entry costs. **EXVOC** and **PRO-DELTA** results will also focus on SMEs. **BIS-FACT** will use study groups to access SMEs and relate their results to that sector of industry.

Summary of expected Resultsfrom AL V

- Identification of good practice and dissemination of results of case studies (**EIOL**);
- Identification of structured and international approaches for quality certification (**EIOL**);
- Identification of barriers for the up take of educational technologies by SMEs and less advanced regions (**ETEE**);
- Assessment of government roles (funding, supportive infrastructures) and opportunities (tariffing, taxes, certification) for the stimulation of open and distance learning (**PRO-DELTA, EIOL**).
- Factors affecting the introduction of ALT (**BIS-FACT**)
- Detailed case studies of national situation (**BIS-FACT**)
- Suitability of certain technologies for certain regions (**PRO-DELTA, EXVOC**)

5. MANAGEMENT OF THE PROGRAMME

5.1 Programme and Project Management

Under the terms of the Council "DELTA" decision, the programme is managed by the Community, with co-responsibility resting with the DELTA Management Committee, which is delegated by the Council of Ministers with responsibility for R&D in the member states.

This formal committee is supplemented by a high level strategic advisory board ("SRB") and a more technically oriented requirements board ("RB"). Each board consists of a wide range of actors, industrial and academic, to ensure a broad range of opinion is available for guidance.

The character of the DELTA Exploratory Action programme, as a strategic action with the technical objective described above, puts particular requirements on its management. The management of DELTA has been divided into the following aspects :

- Project Management;, which is the responsibility of the prime contractor of each DELTA Project. The project manager has to ensure that the project fulfills its objectives within the agreed budget and time frame.

- Programme Management, which is the responsibility of the European Commission, Directorate XIII-F-4, DELTA Central Office (DelCO). Its primary purpose is to ensure that the programme remains on target with regard to the overall objectives, and that the funds are spent legally, and in the interest of the Community in accordance with the Council Decisions. It is responsible for the interactions with the DELTA Management Committee and other official bodies. For this purpose it uses the programme management tools described below.

Concertation Mechanism

All DELTA projects are considered to contribute to the overall objectives of DELTA. Therefore, close collaboration among practically all projects is a prerequisite for success. The concertation mechanism provides the framework for such collaboration.

Concertation Meetings

A major constituent part of the Concertation Mechanism is the series of DELTA Concertation Meetings (DeCoMe's) which take place at about six weekly intervals and are attended by all projects. The projects are represented by their project manager and one or two key researchers relevant to the theme of each "DeCoMe".

The meetings normally last two days and are split into plenary and group sessions of variable geometry. Projects report on their findings, and special themes are selected for each meeting in order to maximize synergy.

Specific Concertation Working Groups

In areas where cooperation between projects seems to be necessary on a bilateral or multilateral basis, working groups have been formed for this purpose, either stimulated by the Commission or on the initiative of the projects themselves.

Programme Management Tools

Some of the tools used by the DELTA Central Office (DelCO) which are particular to the DELTA programme:

Deliverables Management

Deliverables from DELTA projects are "stepping stones" in the achievement of the DELTA objective. Deliverables are therefore to be used as inputs to other projects (obviously observing the contractual provisions for confidentiality). A data base recording the planned inter-project flow of deliverables is maintained by the Delco.

Technical Audit

In October of each year, a report is produced by all DELTA projects, including a self-assessment of the work performed so far in the year, a detailed plan for the following year and proposals for a revision of the overall project plan. This report is subjected to a Technical Audit, in which all projects are reviewed together in the presence of all auditors. The Audit reports serve

as a basis for the Delco's negotiations concerning the detailed plan for the Main Phase and any other adjustment to be made. The detailed plan for the following year is then appended to the existing contract as an addendum.

Management Audit

To ensure that the method of management adopted by the Commission remains relevant to the domain, and is understood and supported by the sector actors while reflecting modern methods and the auditing requirements of the Community as a public institution, the Directorate F undertakes periodically a Programme Management Audit.

Red Flag Procedure

Difficulties encountered by projects, which cannot be resolved from within the project itself, are communicated to the DELTA CENTRAL OFFICE as part of the monthly report under the "red flag" procedure. The Commission then takes the necessary steps to resolve the problem enabling it to lower the flag. DELTA staff can also invoke the red flag procedure when any part of the programme appears to be failing to honour its commitments. Red Flags are normally brought to the attention of the DELTA Management Committee. In this case, as foreseen in the contract, the project concerned may be subject to detailed technical and/or financial audit. One project was red flagged as a result of the Technical Audit in late 1989, and is currently addressing the problems identified by the experts.

5.2 Programme Management Audit

Process

It is important in any research and technology development programme that there is regular and effective evaluation.

The Council Decisions covering the Framework Programme and the specific actions under it (including RACE, DRIVE, DELTA and AIM, for which DG XIII/F is responsible) imply a systematic evaluation and review of the performance with respect to strategic and policy objectives, precise technical objectives and programme management.

To address the first two aspects, DG XIII/F organises Strategic and Technical Audits. The Management Audit that is the subject of this section covers the third aspect; it needs to be done only once in the lifetime of each programme, before the Mid-Term Review, and at a time when most projects are still in their early stages, so that results can be fed back into the operation, in time to guide the remainder of the programme.

Because of the uniform management approach of DG XIII/F it was possible to hold one common Management Audit addressing all four programmes. The Audit was performed in the period June-September 1989 by a team of independent experts, chosen for their direct experience in the essential programme management operations. It addressed the whole "life-cycle" from workplan preparation through to contract execution.

A set of questions were sent to all project partners, and also to a selection of representatives of rejected proposals from the previous call; this written enquiry was supplemented by interviews with project managers and Commission project officers.

Recommendations of Audit Team

As a general conclusion, the Audit Team considers the management approach that DG XIII/F applies to RACE, DRIVE, DELTA and AIM to be both original and appropriate; it is highly successful in accomplishing the specific and general objectives set for the programmes; in several aspects it distinguishes itself favourably from what - in the experience of the Auditors - is normally found in comparable programmes and initiatives.

The overall impression was unequivocally good, even very good.

Any remaining difficulties are of a minor nature. The Commission, in particular DG XIII/F, should definitely continue in its application of this approach, taking care to make the necessary improvements and adaptations as the programmes evolve.

In pronouncing itself on the general appropriateness of the management approach the Audit Team had taken into account not only the precise objectives of each programme, but also - and even mainly - the wider objectives of the Community Framework Programme and of the Communities as a whole, of which these objectives are a part.

The first conclusion was that the main elements of this approach:

- workplan preparation in close cooperation with sector actors
- importance given to system engineering aspects
- consensus making through information exchange

are on the whole well-adapted to the typical objectives and general situation of the programmes, and that any improvements to be made are of a minor nature.

The system engineering part is considered of prime importance to the extent that without it the whole action of the Community through these programmes would be severely restricted in its effectiveness.

As regards promoting awareness of the programmes with potential proposers, the physical and logistic effort spent by each of the Central Offices is at the limit of what can be done with current staffing levels.

Available data show that a wide and balanced participation in the programmes has been obtained. However, while this goal is certainly very important, the Audit Team is of the opinion that quality of participation should have precedence after all. The way the programmes are prepared and the way the technical evaluation is handled satisfy this requirement.

On the basis of the information available to it, the Audit Team notes that the programmes are on the whole well-structured and well-managed. Consequently, its general recommendation is for DG XIII/F to continue to apply this approach to the management of RACE, DELTA, DRIVE, AIM and any future programmes of similar nature.

At the same time, the Team has pointed out a number of detailed issues where improvements can be made, that will enable the programmes as a whole to perform even better in reaching their objectives.

These detailed issues include in particular:

- efforts to promote and explain the programmes well-ahead of Calls for Proposals;
- reaffirmation of the evaluation procedures, so as to avoid misunderstandings;
- payment of the advance on contract signature;
- cost-effectiveness of Concertation Meetings;
- functioning of the system engineering and consensus formation projects;
- optimum size of consortia
- efforts to disseminate information

On the other hand, it was noted that:

- the workplan is successful in achieving a reflection of the priorities of the sector
- the negotiation process was on the whole seen as satisfactory
- there are no major problems with monthly control reports and Technical Audit
- the role of the Project Officer is judged to be well-performed.

The general recommendation is for DG XIII/F to continue to apply its approach to the management of RACE, DELTA, DRIVE, AIM and any future programmes of similar nature.

The efforts of the Central Offices to inform potential proposers and to promote awareness of the programmes are generally appreciated. There are indications of a positive correlation between proposal acceptance and awareness of the programme during the preparation stage. This suggests that especially in the earlier years of a programme, when the circle of those who are directly involved is necessarily small, more should be done to promote and explain the programme well-ahead of a Call for Proposals.

It is necessary to reaffirm the procedure for evaluations, so as to avoid any possibilities for misunderstanding and disappointment: the procedure as currently practiced should be rigourously maintained, and potential proposers should be made more aware of it.

The procedure of having advance payments is considered a good principle. However, in practice payment delays are a source of problems; the Commission is urged to take the necessary steps to correct this situation. In case the delay remains important the partners' additional cost of financing should be allowable under the contract.

The Concertation Meetings are a very good forum for information exchange and to promote contacts, and their function is an essential element in the execution of the programmes. Because the Concertation Meetings are very expensive (travel costs and time spent away from work), one should do everything to make them more attractive and more interesting. Better prepared Concertation Meetings could be organised less frequently.

The topic of Information Dissemination is still addressed insufficiently.

One should be careful not to create projects with more partners than are needed to provide the resources required. In general, five to six partners is the practical limit, except for pre-normative and coordination-type projects.

6.OVERVIEW OF CURRENT STANDARDS IN THE DELTA DOMAIN

6.1 Standards Concerning the Learner Environment

Database access is totally non-standard and not very user-friendly, and there is a strong need for standardisation in interfacing information resources, both for devices and for procedures. Among emerging standards in Europe, the more relevant for on-line services is **X400**, for MHS (Message Handling Systems) with respect to Message Transfer System (MTS), a reliable store- and forward multipoint data transport capability, and InterPersonal Message System (IPMS) providing multimedia personal communications. It includes advanced features such as distribution lists, and more secure messaging.

X500 deals with the OSI Directory/500, a distributed database holding information to support communications. It was ratified in 1988 by CCITT and ISO. Initial applications involve OSI and **X400 MHS** for user friendly naming and distribution lists.

Standards for the representation of multimedia documents include **ODA** (Office Documentation Architecture), which provides for a standardized information structure for representation of documents and **SGML** (Standard Generalized Markup language) is a standard more widely used in the USA.

6.2 Standards Concerning the Learner Interface :

Windowing techniques

The various threads of development in windowing interfacing (also called Graphic User Interface- GUI's) make an extremely complex picture. It is clear, however, that the trend in computer usage is towards GUI's and away from the traditional command line where the user types a textual command. It must therefore be assumed that new ALT software will use GUI as the prime means of user interface. Different approaches: Apple Macintosh; MS-WINDOWS; Systems Application Architecture, Presentation Manager; X-WINDOWS developed at MIT; DECwindows; OSF/MOTIF; UNIX; NeXtStep.

Operating systems

The portability of software is of prime significance in a multi-OS marketplace.

Language : The de-facto language for portability is currently C and the more Lisp-like "C plus plus".

Host Operating System: UNIX is the development system of choice, usually on account of its unique position of being available for almost any machine and because of its close association with the development of OSI software.

Networking: the network development environment for ALT software would be compliant with the OSI Reference Model.

Projects tackle individual aspects of these issues at this stage only.

Document representation

The demands of interoperability mean that any document presentation system which is tied to a particular type or level of hardware is unlikely to prove suitable for ALT usage, where portability and international acceptance are important.

A structured and acceptable system such as SGML or ODA would serve the ALT community best, but some substantial software development is required to provide reliable programs to interpret such documents at a local (workstation) level for all combinations of hardware and systems software in use. It is judged that widespread availability of ODA/ODIF software is possible within 5 years.

Document protocols

Standardisation of document protocols, which is necessary for the communication environment, include the Standard Generalized Markup Language (SGML), used mainly by publishers and Office Documentation Standard (ODA), a more generally applicable protocol, which is developed under ESPRIT.

Multimedia aspects

Current systems are very expensive, based on MS-DOS and analog video, and often poor in quantity and quality. Despite these adverse factors, manufacturers are developing a new generation of multi-media work stations (eg. NeXT, ESPRIT MULTIWORKS).

RAVI is a French standard that covers a wide spectrum of audio and visual standards that are significant in multi-media material, and forms the basis of several investigations both in DELTA and in ESPRIT.

CD Technology, Videodiscs etc. Technologies

Those which appear to have the greatest potential for ALT development are Teletext and CD. Teletext can serve as a flexible, interactive and cheap complement to broadcast TV programmes. CD technologies will be central to ALT as a mass storage device but as yet are inadequate for integrating video pictures of longer than one hour's duration.

Developments in optical technology are coming fast, and it is almost impossible to keep up. At the moment the potential use of optical storage media for Advanced Learning technology can be restricted to CD-A/CD-ROM and LV/LV-ROM. All the other media are only in the "test and evaluation stage" or still under development.

CD-A (Compact Disc-Audio): one uniform, standardized format used around the world.

CD-ROM: The format of the CD was agreed by Philips and Sony in the "Yellow Book". The CD's logical structure (data structure, data access, interfaces and operability in conjunction with various operating systems, etc) was defined at the High Sierra Conference, in which leading manufacturers of CD-ROM decks took part; this is known as the HSP ("High Sierra Proposal") standard. CD-I Moving images deviate from those for the CD-ROM standard (additional data governing video and audio decoding).

DV-I (Digital video-interactive) has industrial standards only, and is not considered by any project, though some contractors have projects in the domain outside of the DELTA framework.

LV (Laser-Vision-videodisc): international standardization, compatible with national television standards (NTSC, PAL).

CD-V: (compact disc-video).: Standards are available for NTSC, but the PAL TV standard does not allow for combined storage of analog audio and digital audio with analog video.

Interactive compact video disc: this is a new video storage standard, totally non-compatible with those already in existence.

Write-once read many: no standardization to date, and new hybrid versions are in the prototype stages in leading developer's laboratories.

Compact Disc-Programmable read only memory: Philips and Sony announced the basic specifications in 1987. Currently he subject of some speculation about its entry onto markets.

Optical diskettes - Read/Write Many. The NeXT computer has the worlds first mass produced exchangeable read writeable optical storage drive. It is a totally unique format, and the media costs are estimated to be at over 50 USD per diskette currently.

6.3 Standards Concerning Telecommunications and Computer Communications

Distributed ALT implementation would be based on several computers involving several processing sites interconnected by a wide area network. Open systems can communicate with other systems and clearly require adherence to OSI (Open Systems Interconnection) standards, and so OSI network standards will be included in any future DELTA system.

The OSI model has grown in the long process of international standardisation. The problem is the certification of conformance of these standards. European PTT's and the CEC have set up conformance-testing laboratories to certify software and hardware in this regard.

In the field of communications, an *ISDN infrastructure* is largely in place. CCITT standardises ISDN and therefore uses a model of ISDN. In this model the services are separated from the network. The interaction between services and network are described by user/network access interfaces. The Terminal Equipment support the services. The terminal equipment is the least standardised part of ISDN.

Message handling: message handling services are internationally standardised by the CCITT. Standardisation started in 1981 and was improved for operational use in 1988. These are the X.400 series. In a few European countries Message Handling Services according to these X.400 standards are in experimental use.

Videotex: three videotex standards are present on a global scale. In Europe all countries except France and West-Germany use the Prestel-standard. France has its own standard (ANTIOPE; Acquisition Numerique et Televisuelle d'Images Organisees et Pages d'Ecriture). West Germany adheres to the European CEPT standard. This is a standard from all European PTT's (CEPT : Conference Europeenne des Administrations des Postes et des Telecommunications).

DELTA '90

Annex A

PROJECT SUMMARIES

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Action Line I

Learning Systems Research

T1.0 Maintenance and Evolution of the Reference Model - The LSRM

The DELTA Pre-Pilot project showed that this domain is extremely complex and unlikely to be resolved by a unique domain model.
As a result of this, there are no current specific projects in this domain. Projects considering the general problems of learning systems modelling include **P7074 ESSENTIAL, P7122, P7126 TOSKA and P7064 ARTISAN.**

T1.1 ELTA - European Learning Technology Association

P7065/D1025 PRECISE - Promoting and Realising ELTA through Communication and Information Strategies in Europe.

T1.2 Stimulation of Processes

P7210/D1005 STARTUP-COMNET - Suppliers for Technological Advanced Requirements Through Users Protocols.

T1.3 Information Sources

P7047/D1023 INTERMAPS "The DELTA Information Services"

P7065/D1025 PRECISE - Promoting and Realising ELTA through Communication and Information Strategies in Europe.

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Workplan References: Action Line I, T1.1

Objectives

PRECISE aims to become the focal point of information exchange and integration in the DELTA domain. This will be achieved through a series of publications, services and events based around learning technology, involving the various actors in this field. These activities promote the development of a human and organisational infrastructure through which the results of research and development can be implemented. Central in this strategy is ELTA : the European Learning Technologies Association. With the DELTA Exploratory Action as a launching base, ELTA will emerge as an independent umbrella association. It will continue to organise events, publish information and provide a platform for information exchange.

Technical Approach

Within the context of DELTA, PRECISE approaches its task through various activities, aimed at actors inside and outside the DELTA projects framework.

The exchange of information within DELTA is stimulated by several central activities carried out in coordination with the DELTA Central Office:

- providing standards and strategies for information integration and task harmonisation,
- monitoring and evaluating the integration of information in DELTA,
- contributing to the information exchange by partaking in the organisation of the DELTA Concertation Meetings.

A series of reports contributes to the basic level of information on specific areas of learning technology:

- on Trends and Issues in DELTA,
- state-of-the-art reports on a number of crucial developments in learning technology: technological approaches in realising open learning systems, distance education, and video / audio conferencing,
- reports on strategic issues: a market analysis, an overview of decision making strategies in making or buying hard / software for Open or Flexible Learning Systems, and a pilot study of the European market for Education technology.

A series of events provide a platform for public information exchange:

- Three seminars related to the three DELTA Action Lines. The aim is to inform non-DELTA contractual participants about the progress in DELTA and discuss goals and preliminary results of the DELTA projects.
- In October 1990 the DELTA conference will take place. The major emerging results of the DELTA Exploratory Action will be presented and discussed.

Information about the future of DELTA, ELTA and European Learning Technologies will be presented both to actors from the field and possible future participants.

All events are set up with a view towards the success of ELTA. Within DELTA the association serves as an umbrella for the participants. Outside DELTA, ELTA will provide services to its individual and corporate members:

- a meeting place for users and providers of advanced learning technologies
- a platform for exchange of information and experience on ALT
- publication of reports and newsletters
- organisation of seminars and conferences
- support of special interest groups
- stimulation of exchange of national developments on a European level.

Key Issues

A major aspect of PRECISE's function inside DELTA is the supply of information to the other projects in order to realise action line or programme (as opposed to project internal) objectives.

The surveys and integration of information will increase and formalise knowledge about the state of the art of use and production of learning technology. They will provide milestones for future developments.

The interfaces between internal project, programme and domain information, strategy and other interests is the key to ensuring that a directed strategy is maintained by all contractors, whilst at the same time the leading edge "users" or procurers are aware of the emerging developments and have the possibility to interact with them in their formative stages.

Impact

From its present intermediary position ELTA will be able to start its operation with the necessary overview of the actors and developments in the complex field of advanced learning technologies (ALT). Gaps to be bridged are between

- actual and future use of technologies, such as courseware production tools, standard facilities for authoring, integrated hardware and software platforms, multi-media applications, telecommunication services;
- actual and desired types of training implemented by user organisations (distance education, open learning, computer based training);
- the various users and providers, such as large industries, hardware and software vendors and users, governmental institutions, universities and open universities, research centres, and training institutes.

PRECISE

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P7210/D1005 STARTUP-COMNET - Suppliers for Technological Advanced Requirements Through Users Protocols.

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Univ. Coimbra, P
Univ. Geneva, CH
Univ. Lancaster, UK

Workplan References : Action Line I, Task T1.2, T1.3.

Objectives

START-UP aims at contributing to improve the production methods employed throughout Europe in pedagogical, technical and economic terms, all of which affect the future expansion of the use and so the market for multimedia materials via:

- analysis of three aspects of current "best practice": those concerned with pedagogic, technical and marketing goals.
- encouraging a European network of producers in order to stimulate the market and ensure its commercial viability.
- providing the European producers' network with information on effective methodologies for design, software environment and industrial implementation.

Technical Approach

The Start Up-Comnet project aims at contributing to the organization of the industrial supply market in the field of multimedia educational and training materials. It relies on three linked strategic actions :

- The organisational action procedure sets the institutional dynamic context wherein the two following action procedures develop.
- The information action procedure is the basis for the capitalisation or valorisation of existing resources and know-how and for the producers' expectations and needs prospect.
- The operational action procedure defines the set of means to be developed, in industrial, technical and pedagogical terms; to prepare the future development of the market.

First Phase :

Two main actions have been simultaneously conducted:

Setting up the Start-Up Network of producers, both at a national level (8 national networks) and at the European level including EFTA countries. This has been realised both through personal contacts and national Postal Survey inviting the European producers to join Start-Up. Building a set of methodological tools in order to conduct a set of case studies and a general framework for analysing the results.

Second Phase :

About one hundred selected Production Centres in Europe and EFTA countries are being audited in-depth on the three main aspects of production process : creation and designing methods, developments tools and production methods. Special attention will be paid to expectations and needs of European producers of technology based material.

Third Phase :

The third phase will be devoted to analysis the results of the audits and the drawing up of a number of operational recommendations on:

- pedagogic, technical, organisational aspects of production;
- user expectations and perceived needs;
- support policy for a supply infrastructure / industry;
- trends and orientations for the development of an open market in learning technology and materials.

Key Issues

The key issues considered by the project are the following :

- Trends on User Requirements.
- A methodological framework for Production review (set out description grids for pedagogical methodology, technical standards and production management) in order to obtain a real image of supply structures in Europe.
- Assessment of European know-how and trends on design and creation methodology for technology based material.
- A "Who's Who" Data Base of European Producers.
- Expertise and recommendations of pedagogical, technical and marketing aspects of technology-based material Production.

Impact

The general philosophy of Startup-Comnet is well understood by Producers who are looking for more professionalism. Non-professionals working in technology based training (TBT) (mostly teachers, trainers and technicians working in organisations which are not or do not feel directly concerned by market issues) are aware, through the Startup-Comnet action, of the economic dimension of educational technology development.

The concept is slowly gaining ground that high quality and low price multimedia material for training and learning enable a more beneficial cost benefit analysis of the economics of multimedia learning.

Conclusions which may be expected in this field concern:

- the structure of the supply,
- the location of the market,
- the general conditions to access/penetrate it,
- the profile of Producers who are well placed in it.

Output, available as reports, includes:

- DELTA - Synthesis, tendencies and orientations
- Methodological Framework for Production Review
- Start-UP Newsletter - 2 versions
- Window on Production article (see INTERMAPS Journal).

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P7047/D1023 - INTERMAPS - The DELTA Information Services

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Workplan References : Action Line I , Tasks 1.1, 1.2, 1.3

Objectives

It is clear from the very breadth of the subject area of advanced learning technology (ALT) and its applications that DELTA has a highly significant but also highly complex task ahead of it. A very large number of specialists from very different areas of expertise must be brought together and stimulated to cooperate successfully across the borders of their usual field of activity, between public and private sector institutions and between the various member states of the European Community and other interested participating parties.

INTERMAPS is an Action Line I project responsible for the communication and publication of progress reports and results of projects funded under the DELTA initiative.

These INTERactive Multimedia Access Publishing Services have two separate tasks:

- Communication between participants in DELTA to help them coordinate their efforts in areas of common interest to avoid duplication and to stimulate synergy
- Communication and publication of DELTA results for the whole European learning technology community to be supported and defined by the activities of ELTA (European Learning Technology Association).

In order to realise these goals INTERMAPS prepares the following deliverables on a running basis :

ENS - Electronic Newsletter Services distributed by the ESPRIT computer conferencing system EuroKom. It consists of:

- an electronic DELTA BULLETIN of about 5 screens updated monthly, a read only facility which is available to all EuroKom subscribers, and which can be exported to other electronic networks if remote users wish to do so. DELTA contractors can submit items to the BULLETIN by writing to the BULLETINBOX.
- DELTA LETTERS, an electronic mailbox, where all users can leave information, contributions, comments and questions, which will be forwarded to competent experts for answers and published if they are of interest to a wider audience.
- an electronic DELTA FORUM, accessible only for DELTA contractors, to ensure confidential internal communication.

DLT NEWS Newsletter

a printed newsletter on the 'Development of New Technologies and Learning in Europe' (DLT) published every two months, about 16 pages long and in at least three language versions (English, French, German) with Italian and Spanish in preparation. It contains everyday central information, with emphasis and variable features tuned for the different language versions. A subscription fee of 20 ECU per year ensures a large distribution. The current print run is 11,000 copies.

DLT Interactive Multimedia Journal

- to disseminate in a more technically detailed way the results of DELTA projects and associated research and development activities. It is of a high scientific standard ensured by an expert "Board of Editors", three issues a year of about 100 pages with lead articles from 10 to 20 pages in length, currently in English language only with enlarged abstracts in other languages. A novel feature is that it includes demonstration of software, prototypes and data on MS-DOS diskettes, and video documentation where necessary. The subscription is 40 ECU per year.

DELTA Video Magazine;

- an audio-visual demonstration of interesting applications, case studies, good practice and actual events related to ALT. Four editions each one of 45 minutes duration, consisting of a thematical, homogeneous, 30 minutes core and a 15 minutes "actuality" shell broadcast via the ESA satellite OLYMPUS, with extensive additional distribution on video cassettes.

INTERMAPS

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Action Line II

Collaborative Development of Advanced Learning Technology

T2.0 Portable Educational Tool Environment - PETE

P7002/D1026 **EPOS** - European PTT Open Service
P7072/D1003 **ASAP** - Animated Specification of a PETE
P7074/D1006 **ESSENTIAL** - European Systems Strategy for the Evolution of New Technology in Advanced Learning

T2.1 Learner Environment

P7064/D1004 **ARTISAN**

T2.2 Training Server

There were no explicit projects with emphasis on this domain. **P7048 ACES and 7023 TMIE** address aspects of this subject. **P7002 EPOS** will develop an implementation for the area, based on the developing PETE concepts however.

T2.3 Learner Expert System (LES)

P7004/D1016 **NAT*LAB**
P7048/D1008 **ACES** - A Courseware Engineering System

T2.4 Mass Storage

There were no explicit projects undertaken in this area. However, **SAFE P7061** will have important spin off in the standards area for CD for mass storage technology. **P7002 EPOS** will implement a simulated mass storage device, and PETE will assume certain elements of mass storage functionality present.

T2.5 Authoring Facility

P7038/D1015 **CAMCE** - Computer Aided Multimedia Courseware Engineering: an Author Tailored Environment to Develop Quality Courseware
P7040/D1009 **MATIC** -Multi-Strategy Authoring Toolkit for Intelligent Courseware
P7061/D1014 **SAFE** - Standard Authoring Facility Environment
P7083/D1010 **AAT** - Advanced Authoring Tools
P7126/D1007 **TOSKA** - Tools and Methods for Sophisticated Knowledge-based Authoring Facility

T2.6 Learning Material Production Environment

There were no specific projects with this primary task, but the projects **P7002 EPOS, 7023 TMIE, 7038 CAMCE and 7210 START-UP** are addressing the issues raised here. Of these TMIE has the most significant effort in this domain.

T2.7 Tutoring and Monitoring Facilities

P7023/D1020 **TMIE** - Tutoring Monitoring Industrial Environment

The project **7002 EPOS** also implements a basic model of this domain, based on the simulation of communications due to restricted timescales for full implementation of a distributed model.

T2.8 Information Resource Management

P7067/D1012 **ESM-BASE** - Educational Systems Based on Multimedia Databases

The projects **7023 TMIE, 7002 EPOS** and **7048 ACES** also consider aspects of this area, as it is an essential aspect of the overall, tutoring, monitoring and learner expert system environment.

P7002/D1026 - EPOS - European PTT Open Service

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Subcontractors
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Workplan Reference; Action Line II, Tasks 2.0 - 2.8, 3.3, AL IV

Objectives

EPOS is a large project which aims to cover virtually the whole range of tasks listed in Action Line II of the DELTA Workplan, and based on the **PETE** concept. The project involves four major European Telecommunications operators (SIP, DBP, Telefonica, Televerket) with practical interests and long experience in the application of Information Technology in this field. It collaborates very closely with other projects in Action Line II, in particular **ASAP** (Animated Specification of a PETE).

The goal of the first phase of the EPOS Project (1989-1991) is to develop technical specifications for a European telecommunications-based open distance-learning service, capable of being implemented during the second phase of the project (planned for 1991-1995). As well as paper based specifications it is planned to develop working prototypes of key components of the service.

During the first months of the project it has been possible to reach a clear consensus in the definition of the main functional characteristics of the proposed service, its overall architecture and the functions to be implemented by specific modules.

As a result the technical specifications currently being defined aim to satisfy the following conditions:

- The service must be designed in such a way as to make a significant contribution to reducing the costs and/or improving the effectiveness of training/education in the partner companies, and to promote and enable technology based education and training.
- The service is capable of extension to users outside the PTTs; in industry, in schools and universities and also eventually in the home. This implies that it should be open to users with differing educational requirements and with a differing ability to pay.
- The service must be educational philosophy neutral, and flexible. It should thus deliver to end users a variety of educational material based on differing educational philosophies. This includes, but will not be limited to, traditional CBT, Intelligent Tutoring Systems, exploratory environments, simulators and audio-visual material.
- The service should be available to users with differing hardware / software platforms. It must be possible to supply a minimum service to users on the computers they already use for other tasks. Equally, provision must be made for the use of more advanced equipment to exploit state of the art learning technology. It follows from these requirements that software portability / interoperability is of key importance within the project. A feasibility study is currently in progress to evaluate the possibility of building a PETE prototype *EPOS Common Platform* which will provide portability across several different systems platforms. This includes portability across different operating systems and graphics user interfaces.

- The service will give users access to a "library" of multimedia educational material, stored in a Database of Learning Materials. As far as possible existing database technology will be used. It is however planned to develop intelligent search and navigation mechanisms incorporating artificial intelligence techniques.
- Support will be provided for the use of multimedia materials, in particular sound and raster images. It is possible that support will be provided for analogue as well as for digital material. Insofar as standards exist (eg. data compression techniques, file formats) these will be supported.
- Material contained in the EPOS library will be delivered via national and international telecommunications networks. The system will allow for the use of different classes of telecommunications ranging from packet-switched networks to narrow and eventually broadband ISDN. It is expected that EPOS will be based on existing telecommunications standards and protocols.
- Support will be provided for interactions among students (groupwork) and between students and human tutors. The learning environment provided by EPOS will thus include tools which facilitate interactions among human agents (electronic mail, computer conferencing, electronic blackboards, video conferencing etc.). Where it is possible to use existing services (e.g. X400 electronic mail services) these will be exploited.
- Attention will be paid to facilitating the production of educational material. Tools will be developed which facilitate the assembly of semifabricates into larger units. These will include semifabricates which were not specifically designed for EPOS.
- EPOS aims to provide end-users with an optimal user interface within the constraints imposed by available hardware and software. EPOS does not however intend to develop its own GUI (Graphics User Interface). As far as possible the EPOS user-interface will exploit existing standards.

Results to date

The work has concentrated on establishing a common understanding of the scope of the projects, and developing initial ideas for each domain, shared by all partners. This has involved setting up a complex management structure to handle the extensive contracting. Effort has been devoted to extending the consortium to take a lead role in the formation of standards in CBT in the PTT arena. Other PTT's will be introduced during 1990.

Technical work therefore has focused on explorative ideas, rather than the determination of too many characteristics at too early a stage. Proposals for each component are now being considered by each of the partners, driven by the considerations above. Additional implementation oriented work is undertaken within the PETE concept to ensure the final harmonisation of the outcome with the results of all the other related DELTA projects.

An initial workshop spanning the whole of action Line II has produced a common understanding of many issues amongst participants in the EPOS project and also an understanding of EPOS in the other DELTA projects.

Currently, the PTT's of France, UK, Netherlands and Switzerland are actively involved in on-going work prior to formal contractual cooperation.

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P7072/D1003 ASAP - Animated Specification of A PETE

Participants	
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Workplan References Action Line II Tasks: 2.0

Objectives

The principal objective of project ASAP is to implement a working prototype of a Portable Educational Tool Environment (PETE). The aim of the prototype is to demonstrate the effectiveness of the PETE concept as the basis for an open learning platform for further developments in the DELTA domain.

In addition to the above objective, ASAP is working to establish close working relationships and cross fertilisation of ideas with other key projects within DELTA, as well as with other projects within the framework of the CEC eg ESPRIT II, and related National programmes.

Technical Approach

ASAP addresses the PETE problem from a strong technological base. This is in contrast with most of the other DELTA projects, which are more educationally based in their approach. The PETE requirements can be categorised under three headings; Presentation, Storage and Distribution.

Presentation

- A sophisticated high resolution graphics environment, based on X-Windows
- A hypermedia based approach to PETE, providing interactive user interface facilities
- Support for a host of multimedia peripherals (eg audio, CD-ROM, video, speech I/O)

Storage

- Support for database storage and retrieval facilities for accessing courseware and educational material

Distribution

- Support for networking and communications.

In addition, the following design features characterise the ASAP prototype;

- PETE portable at all levels - hardware, O/S and software;
- A powerful AI development environment, with an object system, underlying the PETE Environment;
- PETE based on a Unix environment, with the issue of backward compatibility with MS-DOS to be addressed in the next phase;
- PETE to be "educational - philosophy - neutral" by design.

The use of rapid prototyping as a method for design specification has been adopted within ASAP. This methodology is widely used in AI as an efficient and fast method of producing demonstrable results.

Key Issues

In order for the objectives of project ASAP to be fully realised, the project is dependent on other key DELTA projects for input. These are expected to provide prototype Educational Applications, to be integrated to run on PETE, making use of PETE facilities.

The approach adopted in ASAP to technological developments is one of "intercept strategy" - the project plans to intercept current technological developments and trends in 2 plus years' time.

Impact

Results to Date

There is at present a very good working relationship between ASAP and project EPOS, comprising a consortium of major European PTTs, with a two sided commitment for closer co-operation in the design and prototype implementation of parts of PETE. This co-operation is seen as a significant avenue of exploitation of ASAP results.

Results Anticipated

The ASAP - PETE prototype of the current Exploratory Phase is envisaged to evolve into a fuller specification of PETE in the further developments in the DELTA domain.

Demonstrators / Prototypes

ASAP is essentially a practical prototyping project, with 10 out of 22 of its technical deliverables being demonstrations.

ASAP is also an integration project, bringing together a number of existing software components to make up the PETE prototype. It is hoped also to deliver additional unscheduled demonstrations as integration work proceeds.

The animated specifications are implemented and await fitting.

The following are the main demonstrations of the PETE prototype at various stages of integration:

- Low-level support for graphics, networking on CHORUS, March 90
- Common Lisp & object system on CHORUS, March 90
- Educational application running on PETE, Nov 90
- Final PETE Prototype - including a simple educational application interfacing to PETE via a Hypermedia system, on top of Chorus Common Lisp on a 386 PC hardware platform, Feb 91

In addition to the above, demonstrations of the PETE Hypermedia prototype will be given at varying stages of its development.

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P7074/D1006 - ESSENTIAL - European Systems Strategy for the Evolution of New Technology in Advanced Learning

Participants

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Work Programme Area/Task : Action Line II - Task T2.0

Objectives and Technical Summary

This project brings to DELTA a major grouping of industrial and commercial concerns, large and small, together with academic and research institutes. All are united by a common objective: the development of a European consensus on the systems and technology infrastructure needed to support and enable the evolution and expansion of a dynamic European Industry sector concerned with the exploitation of information technology for training.

The overall objective of the project is to produce functional specifications for a Portable Educational Tools Environment (PETE). As such, ESSENTIAL is one of the core PETE projects in DELTA.

The project is addressing the two critical factors upon which the success of this enterprise depends. The first of these is the provision of a technical framework and method which supports the consensus process and provides a common ground for bringing together the disparate technical interests and diverse areas of activity within DELTA. The second is the creation of an appropriate management and technical co-ordination and communications structure which will ensure efficient progress towards our goals.

Our technical approach takes three viewpoints in its investigation of the systems and technologies for training: the efficient **development** of courseware, its effective **delivery** and the **systems** components needed to support both of these endeavours.

Through a series of joint workshops with other projects, ESSENTIAL will develop a requirements model and taxonomic framework through which may be expressed the requirements, policies and constraints of the different actors and enterprises involved, as well as the characteristics of the systems, tools and infrastructure needed to meet these requirements, policies and constraints. From this model and framework we will develop functional specifications of generic tools and toolsets, which will lead to the initial embodiment of a reference model for the PETE.

Impact and results

Significant technical progress has been made so far in the project in a number of areas, particularly in developing the methodology for and implementation of the process of gathering requirements of various participants in the learning systems environment.

The project collects and analyses requirements on learning systems in order to make the correct design decisions. As such it is not prototyping at this early stage.

Requirements capture methodology
The requirements capture methodology was developed using the technique of "Enterprise Modelling". This methodology treats an enterprise as consisting of three main entity types :

- agents,
- activities,
- resources.

An enterprise is defined as 'an agent undertaking an activity to produce a resource, using or consuming another resource to do so'. The three entity types can be linked by relationships in order to describe complex series of accountabilities and responsibilities between participants in the learning systems industry. Rules have been developed for these relations to describe enterprises in general terms.

The enterprise modelling methodology can be expressed in two forms. Firstly, a diagrammatic form has been developed, which clearly illustrates the relations within enterprises. For more complex relations, and also to begin to develop a general theory of enterprises, a formal logical theory, known as the "Enterprise Calculus", has also been developed.

In addition to modelling requirements using the enterprise modelling technique, it is necessary to gather a wide selection of views on the types of tools and technologies that various actors in the learning systems industry would like to see embodied in PETE. This information is gathered at joint workshops with other DELTA projects. The information will be evaluated using content analysis techniques, which in combination with the enterprise models developed will form the basis for the initial design of a PETE.

Functional specification methodology
The development of a methodology for providing functional specifications follows on directly from the requirements capture methodology. The enterprise models, expressed as logical sentences, already provide information in a form which is very close to functional specifications. To these must be added the design decisions which must be taken at all stages of defining and specifying a PETE, and which are based on information gathered from other DELTA projects.

Requirements modelling
The main vehicle for requirements gathering has been a series of joint workshops with other DELTA projects. 19 projects are important to the needs of **ESSENTIAL**. The requirements gathering process was piloted first on an internal basis, with partners modelling their own activities within the learning systems industry, then with project **P7067 ESM-BASE**, followed by five more initial workshops. Following these five, the format of the workshops was further refined, and the remaining 14 meetings carried out.

Taxonomic framework

In order to develop a taxonomic framework for tools used in the learning systems lifecycle, it is necessary to define the lifecycle itself, together with any terms used. This has been done, basing the lifecycle on **activities** and their outputs, rather than roles of agents. In this way, alternative terminology for activities can be fitted into our framework, allowing it to express a generic lifecycle at an abstract level.

The taxonomic framework itself is based on the lifecycle, and will categorise existing and future tools used in learning systems, in terms of the services they provide. Due to the complex set of relations which exist between tools, services and the lifecycle, the final taxonomic framework will appear as a hypertext document.

Co-operation
Within the consortium, there is a wide variety of commercial and academic interests, on a Europe-wide basis. This enables the merging of many disparate views on the learning systems industry, and the synthesis of a consensus view. Each partner in the consortium is emerging as having their own individual strengths, and these are complementing each other within the project as a whole.

Within DELTA, **ESSENTIAL** is playing a major role in co-ordinating among the PETE projects in DELTA. In addition to this, our large program of joint workshops has enabled us to investigate the viewpoints and technical approaches of many of the other DELTA projects. Our task is to bring together these viewpoints into a single embodiment of a PETE design.

The **ESSENTIAL** project is also cooperating with other community funded programs, notably RACE and ESPRIT.

Awareness
There is widespread awareness among the DELTA community of the **ESSENTIAL** project, mainly due to our involvement with other projects at joint workshops and meetings. Numerous presentations have been given on the subjects of DELTA, ESSENTIAL and PETE at Concertation Meetings. An article on PETE has also been written for the Multimedia Journal.

ESSENTIAL

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P7064/D1004 - ARTISAN

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Workplan References : Action Line II : Tasks 2.1, 2.0, 2.3

Objectives

The principle objective of the project is to produce specifications for learner workstations appropriate for general manufacturing industry.

Definitions and specifications for generic industrial training configurations, and standard industrial training tools will also be produced.

In general terms the present and future training needs of industrial SMEs will be established, and the psychology of industrial learning will be investigated in order to elucidate the ways in which industrial skills are acquired and transmitted.

Technical Approach

The initial phase of the project will identify the major factors in the industrial environment, the existing support framework, and the industrial training needs which could be elements of a bottom-up integrated learning configuration. In particular the project will consider ARTISAN skills and the special problems they present on the shop floor and in the classroom situation.

Having established the major elements of the learning configuration, the project is developing specifications for the identified generic elements of the educational environment in manufacturing industry. It will be particularly important to facilitate open-ended and distance learning, primarily for those in SME's. The specifications will reflect the culture of SMEs, and lay the educational technology basis for the skills required to take European industry into the twenty first century. In drawing up the specification full account will be taken of projects already underway in the ESPRIT, RACE, EuroPACE and COMETT programmes.

The workstations will be so specified as to facilitate the further education of existing skilled industrial personnel, such that they acquire the additional skills and competences necessary to deal with the advanced manufacturing systems. In producing specifications for the workstations, due care is given to the possibility of providing learning situations in Universities for undergraduates and post-graduates whose courses will include advanced manufacturing techniques.

The specification will include advanced graphics, dynamic simulation systems, an electronic sketch pad, access to learning libraries, and facilities for portable software.

The end product of the two year ARTISAN project will be specifications for a family of industrial learner workstations. Partners within the consortium, together with appropriate European computer hardware companies, then intend to develop prototype learner workstations based on these specification. The partners also expect to develop an expertise in the application and use of educational technology in the manufacturing sector.

The consortium expects that the specifications for the industrial learner workstations will contain a number of innovations relative to the learner workstations in offices at the moment. These innovations are to be based on the use of advanced graphics, animation, and video, and novel concepts for the human computer interface. The standards emerging from other DELTA projects will be assessed for relevance.

Key Issues

In the above technical approach, the key issues are:

- identification of the present and future training needs of SMEs;
- elucidating the ways in which industrial skills are acquired and transmitted;
- specification of novel human computer interfaces appropriate for industrial learning situations;
- the place of industrial learner workstations within industrial training configurations.

Impact

Results to date

The first deliverable has been completed which provides a framework for the design of the learner workstation for the industrial training needs of environment.

A number of detailed industrial training scenarios have now been produced in preparation for the second deliverable, and work on the first phase of the establishment of the present and future training needs of SMEs is nearing completion.

Results anticipated

Detailed material on the present and future training needs of industrial SMEs will be produced, as well as a description of the ways in which industrial skills are required and transmitted. The latter will be done through a study of the psychology of apprenticeship and industrial learning.

Specifications for standard training tools for the industrial environment will be produced, as well as the final specifications for learner workstations appropriate for the manufacturing environment.

ARTISAN

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P7004/D1016 - NAT*LAB

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Possibly joining during 1990:
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Fiat Auto, I
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Workplan References : Action Line II : Task 2.3

Objectives

Nat*Lab is exploits the most advanced technologies and know-how available today in Europe in a cooperative coordinated and long term effort addressing the issue of a methodology for (semi-)automatic acquisition of student models. This issue is recognized to be of fundamental importance for the authoring and delivery processes. It is one of the hardest goals to be reached in the medium-long term. Any intermediate step towards that goal requires not only a critical mass but also a critical quality of research.

The objective of the project covers design and development of the shell of a knowledge-based system to represent the student characteristics during the learning process. This set of tasks requires cognitive approaches to the learner model and should be fostered by the results of on-going evaluations on the use of interactive learning systems.

Technical Approach

The technical and methodological contributions of NAT*LAB are ensured by the following considerations:

- The partners reflect the best combinations of specific knowledge, experience and skills on the one side, and potential industrial exploitation on the other that may reasonably be assembled and coordinated in Europe today,
- The Artificial Intelligence and Cognitive Science technical components include the most advanced tools currently available, such as overlay models of students, belief representation and reasoning under multiple viewpoints; tutor driven dialogues, guided discovery learning and mixed initiative dialogues; machine learning and the automatic construction of deviating models of the learner as a result of experimental data;
- The methodological component addresses exactly the issue of how to convey incrementally into the learner expert system (LES) the result of on-going experimentations / evaluations on the use of interactive learning systems including a student model, in order to improve their adequacy and the completeness.

The technical kernel of the project consists of the design, development, delivery and evaluation of incrementally more refined prototype LES NAT*LAB, building upon a technique called "inverted dialogues" in which the LES plays the role of student being debugged by the student/user. From an initial "in vitro" prototype, by means of "inverted dialogues", a growing catalogue of possible interpretations of mistakes (misconceptions) is collected. Those are added to the LES knowledge base, enriching in this way the subsequent version of the system. In as far as this inclusion will be automatic, we can say that the LES is itself learning as a result of its own experience with the student (Machine Learning).

The project aims at specific methodological contributions from workpackages that investigate issues in machine learning, second generation experts systems, dialogue management and reason maintenance in a multiple belief space.

As the software / hardware technology needed for obtaining a reasonable efficiency with the above tools is currently in advance of the one available for the delivery of courseware, we will also evaluate how concurrent machines, at present just appearing on the market, may be future implementation media with respect to reaction times and costs.

Achievements to date.

The work in NAT*LAB so far has to be seen in the context of preparing the experimentation phase. In the experimentation phase, the inverted dialogue technique will be tested in a variety of different LES situations, reflecting the LES technology. This preparation work is situated along two lines: identifying good candidate LES's to be included in the experimentation battery and reflecting on methodological and representational issues in which the experimentation will evolve.

The prototype LES's currently being selected, examined, and possibly extended are:

ALICE : a prototype intelligent tutoring system teaching for second language learning, focussing on teaching about the usage of causal and temporal conjunctions, making use of a conceptual representation of the different relations represented by different conjunctions;

ET : a prototype intelligent, tutoring system teaching conjugations of English verbs, applying the currently popular four module architecture for tutoring systems;

BOUWSTENEN : an intelligent tutoring system teaching Dutch grammar, based on an Incremental Procedural Grammar (IPG) which allows easy visualization of sentence structures;

TROTELC : a second generation expert system specialized in diagnosing malfunctioning printed circuit boards. Trotelc is to be extended by a tutoring module to test in what way the deep domain and problem solving knowledge inherent to second generation expert systems facilitates tutoring use.

Studies on the methodology and representation resulted in two relevant proposals:

- LUGA is a unification grammar derived from PATR-II provides both a formalism in which to write grammars and a environment for grammar development. The applicability of LUGA however is still unclear because unification systems have inherent difficulties with incorrect input.
- GTE is a prototype authoring environment focussing on representing expertise about instructional processes. In the context NAT*LAB, GTE's major advantage is that it aims at an explicit representation of all instructional objects involved in teaching, including errors and misconceptions.

Further it is our aim to extend the procedure for student model acquisition to a procedure for user model acquisition or knowledge acquisition in general. Knowledge acquisition has for some years been considered the bottleneck in the development of knowledge based programs.

One of the partners (Vrije University of Brussels) plays in Europe a leading role in machine learning and 2nd generation expert system research. Via NAT*LAB, this expertise is applied to the problems in tutoring and instruction and we expect this to lead to the development of a broad area for further research. Two of the other partners (Universities of Lancaster and Leeds) have been very active in intelligent tutoring research, and especially in the area of student modeling.

The main problems tackled by NAT*LAB are of such complexity and theoretical importance that direct short term commercial exploitation is not a reasonable goal. This does not prevent the project however, from having several spin off activities which may lead to commercial benefit within a shorter time scale, and is attracting major industrial actors.

A number of ITS ideas of a rather scientific nature are being turned into workable prototypes to serve the NAT*LAB partners during the experimentation phase. Those prototypes are intended to be very near to beta-test versions, usable by third parties. This has attracted considerable attention amongst leading industrial organisations who will join the project during 1990.

Further, NAT*LAB developments are serving as a major testbed for the authoring environment and methodology, GTE, currently under development by DIDA*EL, and partly sponsored by two other DELTA projects **P7040 MATIC and P7126 TOSKA**, and a potential comparison base for LISPWORKS.

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P7048/D1008 ACES - A Courseware Engineering System

Participants	
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Workplan references Action Line II Task 2.3, 2.6, 2.7, 2.8

Objectives

The work of the ACES project aims at the functional specification of a Delta Learner Expert. The learner expert is conceived as an intelligent interface between the various users and the services (eg. tutoring and monitoring, information resource management) offered in the learning environment. The learner expert has to interact with each of these different types of user according to their specific requirements. Crucial for the environment is that the interface offered to the user is consistent over services, and adaptive to individual users. In order to provide such an interface ACES will develop an IIMS (intelligent interface management system) using multi-layered user modelling.

The ACES project emphasizes the interfacing of the learner to available services, thus supporting the long-term goal of Delta to create a learning environment that is adaptive to the individual learner. In supporting the learner, ACES concentrates on curriculum and course level. A prototype supports the learner in selecting courses and curricula adapting to learner characteristics like prior knowledge, interests etc. Another prototype will support the user in planning the curriculum, monitoring the student's progress and recognizing 'curricular opportunities' that the student may not be aware of.

Technical Approach

The approach adopted in ACES is a four phase structure leading from initial establishment of project standards, models and review of the state of the art to integrated specifications in the last phase.

Phase I

Establishment of project standards, initial models and requirements. State of the art review in the areas of user modelling, dialogue management and adaptive instruction.

Phase II

Identification of system requirements and their synthesis into a rational maintenance structure. Production of integrated functional specifications for major requirements.

Phase III

Experiment by implementing prototype:

- user modelling and dialogue management system
- curricular support system
- courseware database browser

Phase IV

Production of high level designs and architectures to meet the integrated functional specifications.

Key Issues

In the approach sketched above, the key issues are:

- identification of system requirements
- identification and development of adequate representation
- techniques for user modelling and dialogue management.
- testing representations and techniques in prototypes.

Impact

ACES strives to add value to other projects by exporting requirements that will enable other services provided in the DELTA environment to adapt to the user.

The approach taken to the learner expert has generalisable aspects that stretch into areas like front end information retrieval and advanced guidance systems. It is expected that ACES will not only have an impact on more adaptive (embedded) courseware, but will also have an impact on the development of advanced guidance systems.

Demonstrators and Prototypes

- demonstrator for learner expert dialogue management system
- prototype user modelling and dialogue management system
- prototype curricular support system
- prototype courseware database browser.

ACES

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P7038/D1015 CAMCE - Computer Aided Multimedia Courseware Engineering: An Author Tailored Environment to Develop Quality Courseware

Participation

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Workplan references Action Line II (and III) : T2.5, 2.6, 3.3, 3.5

Objectives

The CAMCE project aims at designing a distributed authoring environment to support courseware production on a Community-wide basis.

Large scale courseware projects have to face several problems: the interaction of users with different skills, the transfer and sharing of components from one part of a course to another, effective and reliable predictions of cost and schedule, and the parallel development of different parts of a course with the assurance that they will work together in the end. Existing environments do not fit these requirements since they are primarily aimed at convenient software implementation.

The objectives of the CAMCE project are :

- to achieve the capability of producing high quality courseware, by providing tools to support all phases of the courseware life cycle, formative evaluation, production of project documentation, consistency and completeness check on data structures,
- to improve productivity in multimedia courseware development, by offering facilities to engineer the authoring process especially by reusing existing learning materials and semi-fabricates.

Technical Approach

The project is divided in five phases aiming at developing functional specifications and prototypes for a multimedia distributed authoring environment.

- Producing a state of the art in the educational technologies and methodologies in order to define a general model of the multimedia courseware development process.
- Specification of the general requirements and the overall architecture of CAMCE based on the above model. An object oriented approach has been used to model the CAMCE architecture in order to ensure functional integration among all the envisaged facilities.
- Detailed functional specifications of the CAMCE environment will be produced. The main envisaged functional components are: author interface, adviser system, object oriented data base, authoring tools, communication services.
- Implementation of a prototype of a system for multimedia design and distributed authoring. The goal is to prototype a distributed tool for supporting multimedia design along with the basic functionalities of the interface, database and adviser.
- Evaluating the prototype for final and formal CAMCE architecture validation.

The functional specifications will be developed with a high degree of coherence with existing telecommunications and data processing standards or similar norms at present under discussion in standardisation committees at European (ECMA, CEPT) and international (CCITT, ISO) levels. ODA and RAVI standards will be considered.

Key issues

In the above technical approach, the key issues refer to the following elements:

- adaptive user interfaces, tailoring the environment to the skills and experiences of the authors,
- integrated authoring tools, providing the project team with intelligent job aids,
- multimedia database to store all the information produced during the courseware lifecycle,
- knowledge based adviser system to support the decisions by the authors during the courseware development process,
- distributed authoring services on interconnected ISDN and satellite networks.

Impact

CAMCE will produce regular reports on the key issues addressed by the project. These deliverables will be conceived in formats enabling their widest possible utilisation within and outside of the DELTA action.

In particular the CAMCE Consortium intends to :

- produce papers for publications in specialized journals on CAMCE research,
- organise open seminars and courses to promote educational technologies and methodologies,
- harness results and intermediate output of CAMCE to build on proposals in the area of learning multimedia packaging in COMETT II,
- provide specific contribution on distributed authoring to the CO-TECH action concerning cooperation technologies inside the Community COST structures,
- exploit CAMCE results to offer quality multimedia learning packages and to provide services of distributed authoring : the industrial partners (Italsiel, Triumph Adler, Fiar, Sodicom, Festo) will guarantee a comprehensive exploitation both for their internal services and for the market,
- perform communication experiments in CAMCE to be made inside the French ISDN network, **Numeris**, and the ESA utilization programme of the OLYMPUS satellite
- experiment with results and intermediate output coming out of projects in other CEC programmes, such as COMETT (**Interactive videodisk to promote computer literacy**), ESPRIT (**Sfinx, Multiworks, Kiwi** and **Accord**) and RACE (**Multimedia Communication, Processing** and **Representation**)

Moreover, the IATIN Consortium is exploiting the know-how and the intermediate output of CAMCE in developing projects funded by the Italian government devoted to the creation of multimedia courseware for open learning in Southern Italy.

The **results to date** are:

- development model of multimedia courseware,
- general requirements and overall architecture of the CAMCE environment,
- user interface guidelines,
- technological choices for prototyping.

The **anticipated results** will be:

- functional specifications of the CAMCE components,
- reports on the major addressed issues,
- prototype of a distributed multimedia design tool.

CAMCE

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P7040/D1009 MATIC -Multi-Strategy Authoring Toolkit for Intelligent Courseware

Participants

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Work Plan References : Action Line II, Tasks 2.5

Objectives

The major objective of MATIC is to draw up formal functional specifications for multi purpose software tools for courseware authors as a central part of PETE. These tools are intended to support both conventional multi-media computer based training (incorporating any combination of text, graphics, sound and video) and intelligent tutoring systems.

It will not be possible to prototype completely such a system in two years. So the aim is to show how the various tools must interrelate and how new components can be incorporated as they are developed. However, certain tools (advice systems for knowledge representation and didactic strategy, editing tools, user interface management tools in particular) will be prototyped.Many of the intermediate deliverables are intended to be used outside the project. Selection criteria and requirements guidelines are being drawn up that apply not only to authoring facilities, but to the resulting courseware as well.

Technical Approach

The project will follow established software engineering techniques, using formal structured design and analysis techniques, whilst preserving the open architecture required by MATIC. An open architecture is essential to incorporate new tools as they are developed, through DELTA and elsewhere. State of the art design tools will be used to allow higher productivity in the project. There are two limitations of such methods for a system like MATIC. There are no adequate formal development methods for knowledge-based systems, nor for ensuring user acceptance of such a 'user-oriented' system, as development tools must be. The methodology used will therefore combine formal methods with suggested guidelines for knowledge-based systems and for establishing user requirements.

The project will work in three phases:

Phase 1. Establishing general user and functional requirements through a combination of analysing current research, evaluating existing systems and surveying users and potential users.

Phase 2. Developing functional specifications that are developed as prototypes to be tested by a selected subset of potential users. The functional specifications are then iteratively refined in accordance with user feedback, utilising a pan-European formal specification system such as SSADM.

Phase 3. Integrating individual functional specifications into a formal set of specifications. These are computer independent, but there will be an attached set of implementation guidelines that have also come out of the iterative cycle of specification, prototyping and user testing.

User acceptance, in quantitative terms, is the primary method of evaluation. 'Users' of authoring systems can be taken to include the authors, tutors and learners.

Courseware authors are identified here in three sets:

- current users of authoring systems for computer - based training
- other CBT authors
- authors who do not currently produce CBT courseware.

We expect the formal specifications to become part of a strategy for a pan European standard for courseware production.

Key Issues

For the Project these are

- Domain modelling
- Representation of misconceptions and learner modelling
- User Interface
- Course specification in terms of
  - learning goals
  - lesson structures
  - lesson objects
- Representation of teaching expertise in terms of
  - didactics (global level)
  - tactics (local level)

For the Domain

- Links to multimedia, user and communications environments
- European standards and distribution.

Impact

Results to date

- Enhanced awareness of ITS and the potential for improved CAI tools within the partner organisations.
- Internal discussion on how to develop a full implemented Production Environment with the specifications.

Results anticipated

Increased mobility of both labour and technology will make severe demands on the efficient production of courseware for the effective training of technical and commercial staff. Countries which have an edge in retraining will maximise their chances of remaining competitive in a rapidly changing world.

Based on specifications turned into commercial software, the exploitation potential is very good. Essential further work will accelerate this. If the software can be linked into a workable communication network with minimisation of language specific restrictions, then the potential for exploitation rises further.

Demonstrators / prototypes expected during 1990 :

- Prototype of the high level interface (first and final)
- Prototype of the domain modelling tools (first and final)
- Prototype of the didactic strategy tools (first and final)
- Prototype of the learner model tools (first and final)
- Prototype of screenflow presentation tool
- Partial prototype of an IAS debugging/simulation tools

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P7061/D1014 SAFE - Standard Authoring Facility Environment

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Workplan References : Action Line II Tasks : T2.5, 4.3, 2.1, 2.6, 4.5

Objectives

- Definition of a basic structure for a Standard Authoring Facility Environment.
- Description of the potential for specific types of open learning material and of the appropriate methods and tools to develop such material, notably simulations and hypermedia (where possible functional designs of tools).
- Description of methods and tools useful for certain aspects of the authoring process (where possible functional designs of tools).

Technical Approach

The project has initiated the pan-European development of a coherent and flexible framework to harness emerging advanced European Learning Technology in respect of facilities for developing Open Learning Material. The project concentrates on taking first steps towards standardisation of facilities and datastructures, and to defining how state-of-the-art Information Technology and Instructional Technology can be merged to develop sophisticated authoring facilities. The main results will be the definition of an Open System for Instructional Development (OS-ID) and functional designs of authoring facilities to be embedded in it.

Two potentially very important types of Open Learning Material are being investigated in detail (simulation-based and hypermedia-based), partly in respect to their instructional potential but mainly in respect to their specific development problems. In parallel to these, several crucial aspects of the authoring process are being addressed in dedicated tasks (eg. subject matter analysis, courseware engineering, design databases, user interfaces). These tasks are not restricted to any type of learning material, but they will investigate how these aspects of authoring can be supported by sophisticated tools.

Emerging standards in the area of multimedia technology (notably CD-I and CD-ROM/XA) and engineering environments (as addressed by the ESPRIT PCTE Project **Atmosphere**) are taken into account, while input will be given to standardisation on authoring environments, hypermedia, and simulation-based systems.

Key Issues

The key issues are:

- assessment of the state of the art
- analysis of the potential offered by technology
- requirements analysis for tools and tool integration
- designing basic architectures
- experimenting with and validation of key issues
- functional specification of key components
- formulation/definition and promotion of standards

Impact

Results include state of the art reports on learning material development, instructional simulations, and hypermedia for learning. Some of these will be published, others have resulted in conference presentations. Basic concepts for developing simulation based and hypermedia based learning material are being formalised, thus structuring these relatively new areas and opening possibilities for exploiting them. A basic architecture for the OS-ID is being discussed with many relevant actors, and is providing input to the definition of PETE and several authoring tools.

The results are the basis for standardisation in the field of advanced authoring facilities, enabling tool developers to adhere to a stable but flexible framework, and enabling tool users to combine tools which are optimally suited for their specific projects. Spin-off projects are proposed within ESPRIT and other programmes, to integrate the (intermediate) results of SAFE (notably the OS-ID architecture) with those of ESPRIT projects, especially in the area of multi-media and CD-technology.

Demonstrators / prototypes

Demonstrators of highly functionality-oriented aspects of an Intelligent Simulation-based Learning Environment and demonstrators of specific aspects of hypermedia are expected in January, 1991.

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P7083/D1010 AAT - Advanced Authoring Tools

Participants

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Workplan References Action Line II : Tasks T2.3, T2.5

Objectives

The objective is to develop an authoring tool which allows the creation of multi-media material suitable for usage by a CAL system, an ECAL system or an ITS (Intelligent Tutoring System). It demonstrates the integration of three forms of presentation and shows how each can be utilised with the same basic material selected from a collection of media resources, created by the author.

There are additional objectives to attempt to predict future trends. In particular, the role of Advanced CAL techniques and the possible future directions for authoring in ITS is addressed. The implications for PETE and consequent standardisation are also discussed.

Technical approach

Sophisticated CAL tools (ORGUE) have been developed, defined an extended CAL paradigm (ECAL) and had developed the worlds first ITS to incorporate authoring tools (DOMINIE). Initially these authoring components were integrated into a single tool. This resulted in the first prototype of the SHIVA system.

The integrated tool essentially supports three separate models of authoring, and has a limited consistency between the components from a Human Computer Interface perspective. The second year of the project involves extensive evaluation of the tool, both within the laboratory environment and with real users, in order to achieve the conceptual integration within the interface.

Key issues

- **ITS and its domain independence**

To date there have been few attempts to develop ITS's which operate across a number of domains. One of the main reasons for this is the bottleneck of course creation, which requires an experienced AI programmer to create a knowledge representation. SHIVA enables domain experts to create such representations directly, and see how they are used. Consequently, it is a major contribution to resolving this bottleneck.

- **Sequence of sophistication**

There is a large gap between the systems used in education and training at a practical level and those which exist in the research environment. Part of this difficulty is due to the conceptual gap between CAL approaches and ITS. SHIVA seeks to resolve the issue by providing a sequence of sophistication which leads the author from CAL to ITS via ECAL (Extended CAL), re-utilising much of the same materials. This is the first attempt to achieve such a logical progression of course presentation systems.

- **Integration of multiple media**

SHIVA represents the state of the art in the usage of multi media for training. It is comprehensive for authoring with existing media in a unified framework. At the same time, the extensible nature of the system supports the integration of new media as they appear.

- **Support for multiple authoring models**

Research has shown that there are many ways to carry out the authoring task, as well as many models of the authoring process. By offering a high level of flexibility, SHIVA allows the author to operate from different perspectives. The system has been evaluated on tasks involving three very different models of processes involved, based on use by novices or experts, and by an individual or a team.

Impact

To date, the major impact of the work has been the effect which dissemination of results has had upon the ALT community. A large number of people within Europe have been made aware of the possibilities of current authoring technology by SHIVA. Work with a number of real end users is also proceeding and will lead to application of the system in realistic industrial environments.

It is intended to use the prototype system resulting from the project to develop courses at a number of sites, including the Open University (UK), DATAMAT (Italy), IRPEACS (France) and SEL (Germany). Additionally, the consortium is committed to further developing the tool to have a marketable product.

Demonstrators / Prototypes

- **SHIVA**

The SHIVA prototype is the output of this project. It is an integrated multi-media authoring tool. The tool demonstrates the most advanced approaches to authoring of teaching materials which is currently possible, and additionally embodies components for the upgrade path from CAL through ECAL to ITS, a central theme of the project. SHIVA includes editors for graphics, digitised pictures, sound, video, control flow, material structure mapping tools and semantic network editing, as well as support for translation of courses between natural languages. The system is a pre-product item which will be further developed by the partners. For this reason it is not available for unrestricted public distribution, but demonstrations of the tool are freely available. The design and development are publicly documented.

SHIVA is being demonstrated to a world-wide audience at WCOE in Sydney.

AAT

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P7126/D1007 TOSKA - Tools and Methods for Sophisticated Knowledge-based Authoring Facility

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Workplan Reference: Action Line II, Task: T2.5

Objectives

The main objectives are:

- to define a generic framework for knowledge-based support of authoring interactive learning environments
- to contribute to the standardization of an authoring methodology.

Technical Approach

The approach chosen is a top-down approach to systems design and development. That is, the partners analyse industrial training needs in different domains to define high-level functionalities of the target system which will be demonstrated in two prototypes.

There are two distinct phases of the TOSKA project:

- The theoretical background is established through the analysis of a large number of training tasks and environments. The analysis deals with different types of content structures, learner characteristics and instructional concepts.
- Implementation and validation of the specified procedures and modules and their integration into a coherent authoring system. On each system layer the implementation will be tested against various criteria.

Key issues

In the technical approach described above the key issues are:

- a requirements analysis
- a system architecture analysis
- the content structure analysis
- an instructional concepts analysis
- a learner characteristics analysis
- a system implementation
- final system validation.

Impact

As TOSKA has a strong orientation towards industrial training needs the consortium tried to establish substantive contacts with possible future users of the system in the industrial sector.

Results to date: a close contact has been established with **Aer Lingus and Mercedes Benz** to support the progress of the project. A commitment is established to use TOSKA features to support maintenance personnel training and sales person training in these companies. These applications will act as validation for the implemented system.

Results anticipated:

The consortium is confident of the potential impact in terms of reduced costs and efforts as well as increased quality of authoring and learning.

As industrial needs and technological aspects are investigated in different member countries the TOSKA consortium expects to prepare the ground for a system which is applicable on a community wide basis.

Demonstrators / Prototypes

- demonstrator using maintenance training examples, 9/90
- demonstrator using sales person training examples, 9/90
- advanced demonstrator using maintenance training examples, 3/91
- advanced demonstrator using sales person training examples, 3/91

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P7023/D1020 TMIE - Tutoring Monitoring Industrial Environment

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Workplan References : Action Line II , Tasks T2.6, T2.7

Objectives

The elements for the production phase and the specific elements of Tutoring and Monitoring during learning will be studied in the project, contributing to DELTA's open learning environment. The project will specify :

- a Production environment
- a Tutoring system
- a Monitoring system,

which facilitate courseware distribution and customised teaching, adaptable to the learner's profiles..

Technical Approach

The technical approach is determined by the top down structure of project :

- Analyse the needs and demands through an investigation of the questions raised by users, addressing the market, tutoring, interfaces, pedagogy and production issues.
- Find the necessary expertise to answer the questions stated in the analysis of the various issues mentioned above.
- Use a work method to conceive and organise the experimentation.
- Put into practice the experimentation and organise the necessary recommendations with a series of precise specifications on the three environments.

Key Issues :

In accordance with the preceding paragraph, the key issues of the project are :

- Expression of demands for TMIE
- Experimental production language
- Implementation of a TMIE
- TMIE experimentation and presentation of results

Expected impact

The TMIE project will produce two demonstrators and a prototype. Elaboration of demonstrators will be in the area of the main parts of tutoring / monitoring and production environment :

- Appreciation of the relevancy of various tools to deal with certain tasks.
- Appraisal of the feasibility of certain parts of Tutoring and Monitoring being supported by these means
- Estimation of the costs and benefits.

The elaboration of a prototype of the TMIE will focus on the choice of functionality and the user interfaces.

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P7067/D1012 ESM-BASE - Educational Systems Based on Multimedia Databases

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Workplan References : Action Line II Tasks 2.8, 2.5, 2.3, 2.0

Main Objectives

The project investigates the concept of multimedia database of learning material (DBLM) considered as a resource for educational applications.

A DBLM is a resource which can be accessed and navigated by learners to achieve some specific informative or educational goal and by authors to design educational processes based on navigation strategies.

The use of a DBLM has interesting implications in the authoring and learning processes:

- It modifies the process of designing new learning material which can re-use components. Already, existing multimedia components can be selected by authors from a DBLM and imported into an application being developed under a specific authoring environment. This allows for an actual courseware reusability in the educational design and may dramatically reduce the development costs of high quality multimedia courseware.
- It provides the basis for a new type of flexible educational systems based on the concept of guided navigation in a DBLM. The term flexibility refers to the capability to meet different learning requirements arising from different contexts with the same learning system. Then the same learning system (endowed with multilingual capabilities) can have a potential market larger than traditional educational applications.

The project deals with several complementary aspects of the educational use of DBLMs and aims at providing specification and significant demonstration prototypes of:

- a conceptual model for a DBLM
- a shell for a DBLM
- a prototype of a DBLM in the field of earth physics
- a user interface for accessing a DBLM
- tools for manipulating multimedia "Units of Learning Material" (ULMs)
- student models oriented to navigation in DBLMs
- an ITS for guiding the navigation of a learner in a DBLM

Technical Approach

- **First phase:**

A conceptual model will be defined of a multimedia database of learning material considered as a resource for authors and for learners. This will include the extension of existing standards for document representation (ODA/ODIF) to include multimedia and pedagogical aspects and the definition of the features of reusable blocks of learning material.

- **Second phase**

The concept of multimedia database of learning material will be demonstrated and validated in all its aspects (including multilinguality) by implementing the following prototypes:

- a shell for a DBLM
- a user interface
- a tool for building Units of Learning Material (ULM)
- an instance of DBLM in a specific content domain

- **Third phase**

A demonstration prototype of an ITS for guiding learners navigation in a DBLM will be implemented. This implementation will provide a further verification of the conceptual model of a DBLM

In all the phases of the project a DBLM will be considered as a potential commercial product and the requirements for such development will be explicitly defined and taken into account.

Key Issues

- Identification of the features of reusable blocks of learning material
- Modelling the interaction of a user with a database of learning material
- Modelling the database requirements of authoring environments
- Integration of software and hardware components.

Impact

The project will produce reports and prototypes covering several aspects of the use of DBLMs in educational applications.

Results to date

- a conceptual model for a DBLM
- a demonstrator of a DBLM shell
- a tool for building multimedia units.

Anticipated results

- a model for multilinguality
- a model and a prototype of user interface
- a model of authoring based on a DBLM
- a specific DBLM
- a model for guided navigation in a DBLM and the related prototypes.

All the results are public and will be widely disseminated though the scientific literature. Agreements with companies are being made for exploring market exploitation potential of the models and prototypes developed in the project

Demonstrators Prototypes

- Prototype Shell for a DBLM, 3/90
- Demonstrator Tool for building ULMs, 3/90
- Prototype Multilingual DBLM in the field of Earth Physics, 5/90
- Prototype Shell of ITS for guided navigation in a DBLM, 1/91
- Demonstrator ITS in the field of Earth Physics, 3/91

ESM-BASE

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Action Line III

Testing and Validation of Communications and of SOFT (Satellite based Open Facility for Testing)

T3.1 Video-Audio Conferencing

P7032/D1028	**OLEW**- Open Learning Experimental Workshop
P7081	**JANUS** Feasibility Study (Joint Academic Network using Satellite for European Distance Education and Training)
P7088/D1011	**LAT** - Learning by Advanced Telecommunications
P7097/D1013	**CAPTIVE** - Collaborative Authoring, Production and Transmission of Interactive Video for Education
P7148/D1021	**OLE** - Organisational Learning in Enterprises

T3.2 Provision of an Information and Programme Exchange System

No specific projects were undertaken in this domain. Eurostep and Channel-E provide elements of such a service. **P7038 CAMCE and 7097 CAPTIVE** cover issues in this area. **P7047 INTERMAPS** is using techniques in this area also, to convey DELTA domain information.

T3.3 Adaptation to ISDN (Integrated Services Digital Networks)

There were no specific projects in this domain. **P7002 EPOS** simulate this domain, whereas **P7038 CAMCE, 7097 CAPTIVE and 7148 ACES** also cover issues related to ISDN.

T3.4 SOFT Operational Plan

There are no explicit projects in this domain. **P7097 CAPTIVE** covers this domain adequately.

T3.5 Satellite Educational Channel

P7160/D1022	**Channel E**: Development of an Educational and Training Satellite Service

Other projects

The projects **P7026 PRO-DELTA** and **P7097 CAPTIVE** also cover parts of this domain.

T3.6 Controlled Experimentation via SOFT

P7016/D1027	**SATDOC** - A Satellite Mediated Controlled Experiment For Continuing Education And Monitoring For Doctors

Other Projects

P7148 OLE and **P7097 CAPTIVE** also cover aspects of this domain.

P7032/D1028 OLEW - Open Learning Experimental Workshop

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Workplan References, Action Line III : Tasks T3.1

Objectives and Technical Summary

This project aims at implementing an Open Learning Experimental Workshop (OLEW) of information technologies with the purpose of experimenting and verifying some information technology techniques to be applied to animate the use of certain technologies for learning.

Tested technology categories to be addressed may include :

- Computer conference.
- Televideo conference.
- Direct Broadcasting by Satellite (DBS).
- Techniques for redundancy reduction in television images.
- Implementation of suitable equipped and organised teaching classroom.

The workshop's main goal will be the creation of a permanent meeting point for different operators (hardware and educational software manufacturers, teachers etc.) coming from geographically remote regions, with carefully selected users in view of a first experimental stage and the implementation of training packages based on a intensive use of advanced information technologies.

The workshop organisation structure will be based on a technology area manager, generally coming from the partner with most experience in this field. Experts from different organisations, will then participate in each workpackage, for a cross-fertilisation of knowledge and skills.

This workshop project mainly meets the objectives of AL III though also addressing issues arising in the information dissemination areas of AL I.

Attention will be given to the finalisation of a conceptual pedagogical reference frame (A type of LSRM - see task T1.0) and the use of satellite and television and broadcasts with emphasis upon the needs of a highly mobile labour force in Europe, both skilled and professional, and the related language problems. In this connection consideration will be given to the needs to develop foreign language skills to follow continuous education and or training in another language whilst located in another member state.

Workshop activities will then be extended to other areas covered by the Delta programme, through connections with other Delta contracts at European level. The workshop will thus be "open" from this point of view also.

The project is currently preparing for a full review of its activities and progress by July 1990.

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P7081 - JANUS Feasibility Study (Joint Academic Network using Satellite for European Distance Education and Training)

Participants

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OPEN University, UK

Workplan Reference, Action Line III: Task 3.1, 3,4, 3,5

Objectives

This is the first part of a two-stage development. The ultimate aim is to establish, in the 1990's a private voice and date network satellite to link up European institutions; both those wishing to work together to produce, jointly, distance teaching and training materials for delivery on a Europe-wide basis and those wishing to transfer credits between institutions.

In order to do this, a number of technical, regulatory, educational and organisational issues have to be resolved. The aim of this proposal is to carry out, in the form of a feasibility study, work that will enable the full project to be successfully implemented. However, it should be noted that the feasibility study on its own will result in improved communications facilities between European educational and industrial establishments.

The feasibility study will:

- determine the cost and design specifications for an appropriate earth station for a voice and data network to link up European distance teaching institutions that can operate on the next generation of European satellites,
- to develop appropriate software to improve the user-friendliness of terminals and work-stations for European-wide communications, and facilitate the interface with satellite earth stations,
- to develop improved operating procedures for computer conferencing, text transfer and editing at a distance,
- to identify and possibly resolve regulatory and cost issues resulting from the European-wide use of two-way voice and data via satellite for educational and training purposes.

The ultimate aim is to develop and install relatively low-cost, narrow-band, two-way earth stations at each site (13 initially, in 10 countries in the second stage of the project), which will allow two-way voice communication between any two sites, audio conferencing across all sites for course team meetings and administrative meetings on credit transfer, electronic mail and computer conferencing facilities for transfer of draft teaching texts, minutes of meetings, etc., and an experimental video-conferencing facility at 64kb/s.

Impact

The network will be used to support the design and development of course materials for courses in four areas: European Law, European Business Studies, European Culture, and European Languages. These courses will be offered in all the 10 participating countries.

In order though for this project to be implemented successfully, it is necessary to develop a European designed earth station capable of working with the new range of European satellites (OLYMPUS, Eutelsat II, Astra). The feasibility study aims to draw up a detailed design specification and to estimate accurately the likely costs of development of such an earth station.

Current operating procedures for electronic mail, computer conferencing, remote editing, and access to remote data-bases on wide area networks are not user friendly. Each of the institutions has varying levels of computer network and telephone exchange capability. The feasibility study aims to work towards use of common communications standards across the 13 main institutions, and to ensure that the earth station will interface smoothly with the ground facilities at each site. The study allows contact between the partners and the relevant government agencies and PTTs.

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P7088/D1011 LAT - Learning by Advanced Telecommunications

Participants

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BERLITZ Sprachschulen GmbH, D
EAP - Ecole Européenne des Affaires, F

Workplan References : Action Line III, Tasks T3.1, 3.3, 3.6

Objectives

The main objectives are

- to analyse and identify future applications of European Learning,
- to specify learner and teacher places in DBS/ISDN and IBC environments on the basis of video-conferencing experiments and exploratory research,
- to propose further essential R&D on learning technologies.

Technical approach

The project starts from the assumption that new communication systems in which video, audio and data processing equipment is combined are excellent media for distance learning. However, essential for this is a system design which is adapted to the specific requirements of students, teachers, type of course and the organisation of the school.

Therefore this project has chosen an approach in which the specification of learner and teacher places is based on preceding exploratory research. Future applications of European Learning are studied first. Video-conferencing experiments are performed to investigate which kind of technical support is needed for various learning applications in ISDN/DBS or IBC environments.

Key Issues

- performance of 5 video-conference experiments with various groups of participants in different countries.
- use of 140 Mbit/sec and 2Mbit/sec video-conferences.
- experiment on management training in the form of real personnel development programmes in enterprises.
- requirement analysis on all experiments.

Impact

The results to date have already stimulated R&D on learner workstations which allow audio-visual communication between teacher and remote learners via ISDN, in addition to 'stand-alone' functions.

The results anticipated will show that ISDN/DBS applications in distance learning are viable in the near future. However, the viability of B-ISDN applications will depend heavily on flexible communication transport mechanisms, such as the IBCN outlined in the RACE programme.

We expect that our results can also be exploited when experimentation is continued and video telephones become available at an affordable price.

Demonstrators / Prototypes

A distance learning application combining Computer Based Training (CBT), ISDN data communication and video telephone was demonstrated at the ISDN congress in Berlin, FRG, during May 1990.

Several other experiments are currently active.

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P7097/D1013: CAPTIVÉ - Collaborative Authoring, Production and Transmission of Interactive Video for Education

Participants

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RUG - Rijks Universiteit of Groningen, NL
TTV - Teletape Video (Granada), UK
OER - Oxford Educational Resources, UK
ULSM -Hospital Santa Maria, Univ. of Lisbon, P
HTG - Hjertelaget, Stavanger, N

Workprogramme References: Action Line III Tasks T3.1, T3.2, T3.3, T3.4, T3.5, T3.6.

Objectives

The main project objectives are:

- The development of an interactive communications infrastructure to test and validate the movement if video images over a broadband cable and direct broadcast satellite (DBS) network. A video image store will be set up at the head-end of the network and images will be transmitted to specific user workstations, either as an aid to the development of courseware or as part of a delivery system for courseware to students in a distance learning environment. The image store would be located at a node (University College London) on the fibre-optic cable network, which also includes the live uplink to the Olympus satellite.
- The development of a knowledge base and associated database in the domain of cardiology at a central site (Katholieke Universiteit of Leuven). This knowledge base would be used to advise authors in the design of courseware, particularly for community health education, and indicate the availability of video material, both moving sequences and still images. The advisory system would have a link with the image store on the communications network.
- The production of video films on heart disease for transmission to the general public by satellite, highlighting issues concerning collaborative production and cultural issues in the EC countries.

Technical Approach

The three sections of the project each raise separate technical issues.

The **broadband cable network** utilises the LIVENET metropolitan network developed by British Telecom and the University of London. This is a fibre optic star network where four video signals are multiplexed on each fibre and a fully interactive environment has been developed for teaching. One of the nodes of this network is the uplink to the Olympus satellite.

An analogue optical disk store is being developed to support both still images and moving sequences with the associated image database. There will be multi-user random access to the disk to retrieve images in less than 500 milliseconds. 36,000 images can be stored on any one side of the disk.

Further work is being carried out to include a coded address in the non-visible part of the video signal to direct images to specific workstations. This work is also indicating the specification of low cost interactive workstations based upon television technology to receive transmissions from satellite. The return pathway for interactive information would be through ISDN when and where this is available and use would be made of electronic mail techniques.

Key Issues

The technical approach introduces the following key issues:

- The use of analogue and digital techniques for video image storage.
- The design and function of head-end of network for image transmission.
- The design of techniques for single frame transmission to specific address.
- The design of low cost interactive workstations to receive from cable and satellite.
- The use of ISDN and electronic mail for the return path in interactive systems.
- The description of images in image database.
- The links between advisory system and video database.
- Remote access to central site databases and advisory systems.
- Cultural issues in video production for satellite.

Expected Impact

The project will produce regular reports and will also deliver demonstrations.

Results to date:

Reports

- data communications network to access Knowledge Base
- use of cable network (LIVENET)
- intermediate report on design of Knowledge Base

Results anticipated:

Reports

- interactive video techniques
- video production techniques
- use of network for pre-production collaboration
- linear video prod. from interactive transmissions

Demonstrators

- receiver station and graphics head-end equipment
- ISDN interaction
- cardiology video films

CAPTIVE

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P7148/D1021 OLE - Organisational Learning in Enterprises

Participants

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Workplan References Action Line III Tasks: T.1, T., 3.

Objectives

The overall aim of the OLE project is to specify and test facilities, guidelines, and proposals for on the job training to be used for defining future learning systems. This includes:

- functional descriptions and specifications of a module based teacher and learner station with a flexible and user friendly functionality,
- functional specification of computer conferencing facilities able to handle text, graphics and still pictures in computer based learning environments,
- specification and the implementation of functionalities simulating proposed ISDN services on a user level.

Technical Approach

The perspective of system development aims at the end users and the technology as a medium capable of supporting learning as a process.

The approach which has been chosen is a full scale test environment with a stepwise prototyping of the teacher and learner station. There is a dual strategy :

- to apply stable and reliable technology in the course;
- to make adjustments and developments to be integrated in the educational workstation and the courses as soon as these prove to be sufficiently stable and user friendly.

The prototyping cycles involve parameters such as educational needs, functional requirements, specifications, the creation of technical systems, systems test and full scale test and validation. This is executed in two main phases, prototyping and full scale test at ECCOLET, Denmark and also in Portugal.

This prototyping is based on known technology and consists of the following components,

- a two way audio/video communication system (freeze frame phone system)
- a PC based system including
- author/educational support application
- a database management system
- access to computer conferencing systems
- electronic blackboard system
- still image communication system.

Standards for data representations, electronic mail, office document architecture, and file transfer to the computer conferencing system EIES 2, are in accordance with the prevailing standards within this field such as CCITT X408/ISO 8824, CCITT X409/ISO 8825, CCITT T.411 - T.429, ODA, ODIF, and ISO 85711 FTAM.

Key issues

- identification and description of functional requirements according to educational needs in a distance learning environment
- test and validation according to functional description
- specifications according to prototype functionality
- considerations concerning future distance learning systems.

Impact

Results to date

- functional descriptions and specifications
- freeze frame phone system
- PC support system
- computer conferencing system
- electronic blackboard system
- prototype of a modular teacher and learner station.
- carrying out of courses in Denmark organised as on the job training via distance learning and learning technology (prototyping). This also implies the test and validation of the teacher and learner station.

Results anticipated

- to redesign teacher and learner station by implementing still image communication facilities and EIES 2 in the PC-based system;
- to actually execute and metricate courses in Portugal via learning technology;
- to identify major technical, economic, cultural, language, pedagogical, and organisational problems related to distance learning and training via advanced learning technology according to testing and validation through extensive field trials;
- to produce a concept of flexible learning technology as a medium for distance learning and supplier support. This implies the use of learning technology for SME's with geographically separated branches or a geographically dispersed clientele;
- specifications to be applied by systems producers, telematic services related to development and adjustment of technology and services for the use in distance learning and training.

Demonstrators / prototypes

- prototype teacher and learner station
- workshop / demonstration
- prototype of teacher and learner station 3/90
- a demonstration disk 3/90
- workstation / demonstration 5/90.

OLE

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P7160/D1022 Channel E: Development of an Educational and Training Satellite Service

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Workplan References: Action Line III, Task: T3.5

Objectives

The objectives include the broadcast of at least four series of educational, informative and training programmes using the ASTRA satellite in order to assess and evaluate the potential of a multilingual educational television channel for Europe. In practice, and for reasons set out below, more programmes and hours will be broadcast than proposed in the original workpackages.

The use of the ASTRA satellite makes the programmes accessible to a wide range of European viewers in their homes, at work and in educational institutions, using existing and widely available technology and with the requirement for little or no additional expenditure.

It has become evident that the nature of satellite television broadcasting is such that intermittent or occasional broadcasts are unlikely to achieve significant audience penetration : it has therefore been decided to implement a daily service; initially five days a week, with a view to establishing audience loyalty and facilitating the audience research and evaluation of results.

Additional work is undertaken on the use of satellite transmissions for data-casting, on the establishment of common course accreditation in Europe and on various techniques of broadcasting in more than one European language.

Technical Approach

The technology used is the established technology of medium and low-power satellite television broadcasting, and a conscious decision has been taken to use PAL 625 lines as the transmission standard in preference to one of the MAC packet family of standards. This is because the availability of D2-MAC receivers during the life of the experimental phase is limited and PAL 625 is the dominant technology in installed reception equipment in most of Europe.

The choice of playout tape standard is, similarly, determined by the de facto standards of satellite broadcasters. While it would be possible to use either Sony U-matic high band or SVHS tapes for playout, the vast majority of playout centres are equipped to play Betacam SP cassettes. It is on this standard that Channel-E programmes are to be provided.

Key issues

The key issues in the development of Channel-E are:

- The availability and deliverability of suitable programme material with all necessary rights cleared for satellite television broadcast and possible further cable relay, together with appropriate written support materials and development of satisfactory means of audience interaction either with the programme makers or other tutorial staff.
- The acceptability of the material to the audience in terms both of educational content and presentation, and of language.
- The willingness and capacity of the audience to receive educational material in this form.

Impact

The impact of Channel E transmissions on the audiences will be assessed and evaluated following the start of regular transmissions. It is expected that audiences will need time to familiarise themselves with the availability and nature of the Channel E broadcasts, a two-part process of development is therefore necessary :

- **familiarisation of the producers of educational and informational programmes with the availability and requirements of Channel E**
- **familiarisation of the audiences with the availability and content of Channel E**

Results to date

The main results of the Channel E project will of course follow the start of regular transmissions, and will depend on the establishment in the European viewers' minds of the idea of a regular and reliable appointment with the service.

Early results, however, of value to the development of distance learning by television in Europe are:

- **Identification of significant sources of existing programme material, suitable for broadcasting and cleared of the necessary rights.**
- **Establishment of the principle of financial support for the technical costs by the programme providers.**
- **Definition of first principles for standardised multilingual presentation of educational and informative broadcasts.**

Results anticipated

- Cost-benefit analysis of the results of the experimental broadcasts in the four main strands defined in the workprogramme, including different techniques of language transfer and audience interaction.
- Identification of possibilities of commercial development of an educational television service by satellite in the medium and long term.
- Establishment of standards for presentation of educational and informative programmes in a multilingual environment.
- Identification of sources of revenue to sustain the service in the medium and long term, with a view to the eventual development of a full-scale European Open Learning Channel carrying both television and data services to a range of users throughout Europe.

CHANNEL E

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P7016/D1027 SATDOC - A Satellite Mediated Controlled Experiment For Continuing Education And Monitoring For Doctors

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Workplan References : Action Line III Task T3.6

Technical Summary and Objectives

This project is to produce a controlled experiment of satellite broadcasting for General Practitioners using a newly developed information centre (BEMIC) in five European University Departments of General Practice.

A Broadband Educational Medical Information Centre (BEMIC) has been developed as a phased project for the medical profession. The first phase, **BEMIC 1**, incorporates a video recorder and television set with a specific encryption system and the facility to auto-record broadcast material in response to a transmitted signal. Thus the machine will record educational material transmitted in the middle of the night at times of low cost transmission. The second phase of this project develops **BEMIC 2**, which incorporates a PC computer and appropriate modem. This enables the learners to be linked back electronically to the tutor for monitoring and accreditation purposes. The final phase of this development of the BEMIC system,BEMIC 3, incorporates a CD-ROM for data storage.

Specific video material prepared by the education group of the project will initially be broadcast via an existing communications satellite to the European collaboration centres for testing and assessment. An electronic link back via a modem will be developed to ensure the monitoring of the learning process. A second video program will be made and the feedback link incorporated and tested. The third specially made video program will be broadcast and it will incorporate the technical and educational improvements of the feedback link to be developed in the light of the experience gained with the second program. In addition the feedback technology will be utilised to develop methods of evaluation of the effect of language on the learning process.

Achievements To Date

Technical Progress

PIPA-crypt, (Preset Infra-red Programme Accessor) has been developed to solve many of the inherent problems of both satellite and terrestrial television broadcasting. It enables the teacher to disseminate distance learning programmes by television using inexpensive "down time". Copyright and authorship are safeguarded and the learner is able to use the interreactive aspects of the technology to respond to the learning material. A degree course in Dermatology is already underway in the UK using this technology.

Thus PIPA-crypt has six important functions:

- Automatic TV recording when attached to a VCR enabling use of cheap off-peak TV time.
- Encryptic system: The PIPA-crypt will also de-encrypt the transmitted programmes, which have to be encrypted in order to conform to various statutory regulations on medical programmes. It is possible that this encryption system, developed through DELTA, may become the standard European encryption system.
- Educational electronic feedback links from the learner to the tutor, central to any effective learning process. The PIPA-crypt has a very sophisticated link-back mechanism.
- Red alert system, a light alarm which can be lit by a specially transmitted signal.
- Addressability - it is virtually infinitely addressable.
- Copyright and security -.Programmes de-encrypted by a PIPA-crypt/VCR machine can only be replayed in a similar machine.

Television Productions

One programme deals with the overall concept of the DELTA project and also demonstrates the technology, PIPA-crypt. It is intended as an introduction to the project for the participating user groups in the five European collaborative centres. It has been well received and has also proved of value in demonstrating the progress to date to key personnel in the UK Government and to interested European Parliamentarians.

Another programme intends to explore the cross cultural and language aspects of distance learning. It was felt important to ensure that, as far as possible, a European style of presentation should be adopted for the presentation of the educational input, and that the use of English as opposed to the viewer's own language should be assessed. The second DELTA television programme deals with technical procedures for General Practitioners in the field of minor surgery. It has also been made in Spanish and French for use with appropriate European groups.

Co-operation

The most unexpected and rewarding aspect of our participation in the DELTA project has been the numerous opportunities for collaboration with other DELTA colleagues, especially from Action Line III, notably:

- **AAT 7088** - working with CONDAT and the Berlitz School of Languages, a number of medical tele-conferences have been arranged between the Royal Society of Medicine in London and a similar prestigious medical society in Germany. Expansion of this collaboration is envisaged in the future.
- **OLEW 7032** - our commercial partners, British Medical Television are having useful meetings with our Italian colleagues in DELTA exploring the concept of utilizing PIPA-crypt in distance learning programmes for Italian doctors.
- **CHANNEL E 7610** - It is intended to use Channel E via the Astra satellite for a series of programmes made by British Medical Television for the public on general health matters.

In this way, experience of broadcasting via the Astra satellite will be obtained.

Awareness

The **SatDoc** project is exploring practically the use of PIPA-crypt in five European settings. It is evaluating the cross cultural and language problem inherent in European learning programmes. Finally it is experiencing the practicality of using not only the Olympus satellite but also Eutel 2 and the Astra satellite as comparison.

Future Development

The general principle will be to develop for the medical profession the main deliverables and expertise generated by the DELTA project. These fall essentially into three areas: firstly, the deliverable PIPA-crypt, secondly the production of a number of television programmes in education with special reference to an assessment of language and cultural barriers to learning; finally, practical experience will have been obtained in the use of three different satellite systems (BBC Eutel2, Astra and Olympus).

Although these projects are being developed for doctors, it is envisaged that they have a wide application to many other sectors of adult learning and re-training, and discussion on their application to language teaching and international business management has occurred with our German colleagues in CONDAT and the Berlitz group.

Current Areas of Development in PIPA-crypt

PIPA-crypt is seen as central to the development of low cost satellite mediated, accredited learning packages and currently is seen as the vehicle whereby a pan-European news / education system for doctors may be developed. Our current DELTA partners in Spain, Belgium, Holland, Ireland and the UK, have provided a valuable demonstration test bed and acted as a focal point for more widespread dissemination of the concept. A daily medical news programme together with education packages should be developed for both GPs and specialists. An attempt is being made to develop a European style of television for these programmes. Experience with languages and cross-cultural barriers is of great value in this respect.

The next step is to develop this service for our other projects. This is the subject of advanced discussion with Dida*El in Italy and with the Irish Medical Association.

Teleconferencing

A useful pilot study is under way with our German colleagues in CONDAT in which the Royal Society of Medicine is being linked to a similar prestigious medical society in Germany. The next phase of this concept would be to link eminent and prestigious centres of scientific excellence via satellite conferencing facilities to set up a permanent communication exchange of matters of scientific interest. A number of eminent European institutions and centres of excellence have already

expressed an interest in this idea. Thus a test bed which could easily be expanded would be created for European scientific teleconferencing.

In the fast changing political climate occurring in East Europe, there will be opportunities to introduce Information Technology to Eastern European in a very useful and meaningful way.

Further Satellite Broadcasting

It is intended to provide Channel E with some ten hours of specially made television programmes on topics of health care for the general public. The subjects covered range from problems with back pain, heart disease to childhood ailments. These programmes will be broadcast via Channel E on the Astra satellite. They will be in English in the first instance, with other European languages being actively considered.

HDTV

Surgical and dental procedures provide an ideal application project for the use of HDTV as they give the learner a very clear sharp image essential for effective teaching in this field. Preliminary discussions with a major European interest in HDTV are at an early stage.

Interactive TV / Video Development

As part of the DELTA initiative, the R&D department of British Medical Television have developed the functional specification of a low cost interactive TV facility. It works on the principle that a small scanner can "read" a series of computerised instructions concealed in the television picture. Thus the learner is involved with learning material in a very dynamic way.

The commercial development of this technology, in which a European manufacturing partner would be required, is under active consideration. Preliminary discussions in this field look hopeful.

Summary

It would appear that the deliverables and expertise of the current DELTA project are developing into a number of limited pan-European application projects in the creation of information technology networks for medical education. The deliverable **PIPA-crypt** would seem to be embraced within the overall philosophy of the **PETE** concept. The envisaged development of **HDTV** and low cost inter-reactive TV would complement these existing application programs. Furthermore, these projects can not only act as a technical example of this kind of education but also enable this technology to be evaluated in the economic market place of European learning.

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Action Line IV

Interoperability

T4.1 Learner Environment

T4.2 Information Resource

T4.3 Authoring Facility

T4.4 Tutoring and Monitoring

T4.5 Integrated Production Environment

T4.6 Telecommunications.

Two projects cover the domain well and therefore are presented as overall coverage for the six tasks , they are:

P7042/D1001	**LEAST** - LEArning systems STandardisation
P7209/D1002	**OSIRIS**- Optimum Standards for successful Market IntegRation of multI-media on-line Services

These are described in the pagers which follow, without a detailed task by task analysis because of the width of the approach which they take.

Other projects

P7061 SAFE also covers aspects of **T4.3**, which is also touched by **P7210 STARTUP -COMNET.**
P7002 EPOS touches on areas of **T4.4**, while **P7081 JANUS** addresses issues under **T4.6.**

P7042/D1001 LEAST - LEArning systems STandardisation

Participants

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Workplan References : Action Line IV, Tasks T4.1 - 4.6

Objectives

The LEAST project mainly aims at dealing with standardisation and interoperability on the technological side.

The objective is to develop recommendations for the selection of emerging standards and for the representation and exchange of information between the different learning sub-systems.

In that framework, the three main technological areas of concern of the project are:

- selection of standards for the representation and exchange of multimedia information, both basic information (such as graphic, image, sound, video sequences, etc) and for structured information (such as courseware, script, etc);
- recommendations on adaptive and general applicable user interfaces;
- selection of standards for telecommunication protocols for the exchange of applications.

Technical approach

In order to reach the objectives described, the following technical approach has been adopted:

- definition of an overall model of a Learning System in order to precisely define the different actors intervening in a Learning System and their role, the different subsystems a Learning System is made of, and the information exchanged between the actors and the Learning subsystems on the one hand and between the subsystems themselves on the other hand;
- analysis of the functional requirements from the different actors' points of view in terms of information exchanged and, in parallel, critical review of the adequacy of some a-priori candidate standards for the interface identified;
- merging of the previous surveys in order to output proposals and recommendations for standards.

Key Issues

In the above technical approach, the key issues are:

- synthesis of the functional requirements of the learning actors;
- cooperative and critical state of the art of existing or draft standards in the technological areas of concern of the project;
- proposals for and dissemination of various standards;
- adoption of the standards by the learning DELTA community.

Impact

The LEAST project will propose and recommend the use of standards especially for courseware representation, processing and exchange. They will therefore have a strong impact on the representation of courseware generated by the Authoring systems and on the PETE specifications and prototyping.

Results To Date

- **Synthesis of the functional requirements from the different actors points of view;**
- **Critical state of the art review of some relevant existing or draft standards.**

Results Anticipated

Various firm proposals for standards in the areas described above, after consultation and concensus with the DELTA actors.

Demonstrators / prototypes

LEAST project is mainly a survey project aiming at validating only some reduced demonstrations, the adequacy of the options which will be proposed for the choice of standards will be carried out by the end of the project.

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P7209/D1002 OSIRIS- Optimum Standards for successful Market IntegRation of multI-media on-line Services

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Workplan References : Action Line IV, Tasks T4.1, 4.6, 4.4, 4.2, 5.2

Objectives

- OSIRIS' chief operational objective is to critically examine the relationship between advanced learning technology, standards and productivity in Europe.
- OSIRIS aims to assist large industrial and commercial organisations in Europe improve their competitive positions through the application of Advanced Learning Technology (ALT) in their Human Resource Development (HRD) activities through :
  - A multi-perspective examination of the reciprocal influences of market and standards,
  - The study and specification of systems architecture which will reduce the costs of distributing training courseware, facilitate training services management and thus enhance tutor learner interaction.
- OSIRIS recommends strategic approaches for the market integration of ALT, to overcome current economic, technological, organisational, psychological and sociological obstacles to its acceptance.

Technical Approach

OSIRIS is a strategic study which will examine technical standards and human competence in relation to ALT in real market situations, not a technical pilot programme. It will critically examine possible standards for an open learning environment in Europe, and will make positive recommendations on future standards.

OSIRIS uses a two phase approach :

- In phase one, OSIRIS will gather an extensive knowledge of Open and Distant Learning by studying the current environment of ALT covering technical, sociological, psychological and economic factors, and by studying the current situation of training in a significant number of European companies. Phase one will be concluded by the construction of a model of effective learning in order to generate statements of hypothetical standards.
- Phase two will validate these standards by testing them with training users and providers in industry and commerce. These standards will drive the development of ideal / typical functional and technical specifications for ALT.

Recommendations for a cost-effective learning system and organisation will then be drawn with practical aims.

Key Issues

- the willingness of organisations in different parts of Europe to invest in ALT at the same rate and to the same scale - the standardisation of the market.
- Current practices and perspectives for integrated standardisation (i.e. interoperability) at the European level in technical infrastructure, ALT environment, learner and tutor competence and organisational adaptability
- The prospects for standardisation and interoperability of ALT design tools to enable flexible interface construction, accommodating varied training environments and needs.
- Recommendations on additive and generally applicable user interfaces and presentation models will be made.
- Optimal combinations of academic specialisations to design ALT solutions.

- Co-ordination of organisations in the goods and services sectors involved in the design, production and exploitation of training systems based on advanced networks.
- Design of integrated learning systems with advanced components.
- Recommendations on standardised design methods and protocols supporting transfer of learning materials.
- Critical definition of and supposed standards for Open Learning.
- Identification of criteria for qualitative assessment of learning materials and learning environments.

Impact

Results to Date

- **Characteristics of Interoperability Environments** :

This synthesises the outcomes of investigations into the sociological and psychological implications of, and context for the development of Open Learning in general, and Learning Technologies in particular, a review of available and emerging technologies (ALII, Tasks T2.3 & T2.4), and an examination of relevant State-of-the-Art research in Europe, North America and Japan.

- **Characteristics of Current and Emerging ALT Use:**

This will present the findings of a large-scale (over 600 industrial and commercial respondents) examination of expressed and latent user demand, current and emergent supply-side strategies and demand / supply integration.

- **Economic Criteria for ALT Standards** :

This research has two components. The first is an assessment of how DELTA can usefully address the complementary questions of technical standards and human capital formation in order to enhance both the efficiency and rationality of economic organisations. The second examines the processes by which technology products such as Advanced Learning Technologies are diffused in Europe.

Results Anticipated

The generation of indicative, problem solving, functional specifications based on lead user testing in the four environments. This will include specifications of advanced systems components.

This will feed into the formulation of standards / recommendations integrating the preceding activities in order to generate optimum standards for ALT design. It will also deliver policy recommendations for future possible Community action in the areas of standards and market integration as they relate to ALT.

Demonstrator

OSIRIS will produce a user driven specification for the development of cost effective and efficient ALT.

OSIRIS

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Action Line V

Promotion of Favourable Conditions

T5.1 Economics of Learning Technology Applications

P7026/D1019	**PRO-DELTA** - Portuguese Research on DELTA
P7053/D1017	**EIOL** - European Infrastructure for Open Learning
P7113/D1024	**EXVOC** - Expert System Contributions to Vocational Training

T5.2 Factors Affecting the Use of Learning Technology

P7162	**BIS-FACT :** Distance Learning - Inhibiting Factors and the Creation of Favourable Conditions
P7122/D1018	**ETEE** - Educational Technologies For European Enterprises

T5.3 Impact of Telecommunications and Broadcasting

There are no explicit projects in this task area. **Channel-E P7160 and SATDOC P7016** cover major aspects of this area. **EIOL P7053, JANUS P7081 and BIS-FACT P7162** consider certain specific issues under this heading also.

T5.4 Copyright and Authors' Rights

No projects address this issue in depth, but **EIOL P7053** looks at it. There is an emerging EC policy on the subject of copyright which includes the issues of electronic copyright, and **ESPRIT** is currently reviewing major technical proposals to implement some concepts for solutions under the 1990 ESPRIT Call for proposals.

P7026/D1019 PRO-DELTA - Portuguese Research on DELTA

Participants	
Fundetec, P	IAPMEI, P
Universidade Aberta, P	Saturn, NL
ITEC, P	ERC, IRL
	DEUS, DK
	CRCI, F

Workplan References : Action Line V (and I) Tasks T5.1, T5.2, T1.2.1., T1.2.2, T3.5

Objectives

Within the Open Learning area of high technical training the main objective to be achieved through the research work proposed is a contribution to the design of an LSRM (Learning System Reference Model) for Portugal, and similar countries, as a direct contribution to the definition of an evolving European LSRM. This helps to analyse the favourable conditions and factors affecting the use of learning technologies (ALT). This analysis will be made with the contribution of experts from several European countries and its validity will be assessed by experimentation both in Portugal and in France, mainly with SME's.

The fundamental milestones are the following :

- Analysis of national capacity of courseware production considering scientific areas, technology and know-how, man-power, costs, distribution systems availability and technology penetration.
- Market characteristics and dimension for high technology training considering social and economic conditions for the penetration of learning technology in industry and home environment. An exploitation plan for the diffusion in Portugal of the courses provided by an European Educational Satellite Channel will also be assessed.

Technical Approach.

The definition of a LSRM is, by nature, a complex evolving process, where cross-fertilization between all DELTA projects is a fundamental factor.

The inter-relationship with the European partners and interactions within **COMETT, COMNET (P7210), SATURN and EUROPACE** will support and contribute to the proposed research. Also, intermediate DELTA meetings will keep information flowing concerning important matters like technology and standards.

This project has been conceived for 24 months, as follows:

Part A :

Year one - 2 task-force groups will study the two areas presented as objectives, with written reports produced.

Part B :

In the 2nd year, the results will be compared, analysed and measured according to an evolving LSRM for the European situation in general or specific countries in particular. A reassessment of the project's LSRM will then be made by the same two task forces.

Seminars and Demonstration will be undertaken. The contribution of the task force will finally be integrated in one final Report.

This project is structured around the work of two task-forces responsible for the two workpackages, whose objectives are:

WP1

- Analysis of national capacity of courseware production considering scientific areas, technology and know-how, man power, costs, distribution systems availability and technology penetration.

WP2

- Market characteristics and dimension for high technology training, considering social and economic conditions for the penetration of learning technology in industry and home environment. An exploitation plan for the diffusion in Portugal of the courses provided by an European Educational Satellite Channel will also be assessed.

Impact

The project results will provide a comprehensive deep knowledge of high technology training, both from demand and supply sides. The impact of this knowledge is an increasing adaptation to this market needs for the transnational training supply technologies and services.

Available reports are :

Intermediate Report A1 - "Intermediate Report on the Segmentation of the market in Portugal on the capacity of courseware production".

Intermediate Report A2 - "Intermediate Report on the Segmentation of the market on Portugal of high technology training needs".

Intermediate Report B - "Intermediate Report on the establishment of different scenarios for Satellite Educational Channel reception and diffusion".

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P7053/D1017 EIOL - European Infrastructure for Open Learning

Participants

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GES, UK
Integrated Information Systems Ltd.,GR
ISFOL, I
Istituto Bancario Paolo Di Torino, I
METROTEC (CSEA), I
NIHE, IRL
Provincia Regionale di Catania, I
SCIENTER, I
Scuola Radio Elettra s.P.A., I
Universita De Bologna, I

Workplan references : Action Lines V (and I) Tasks T5.1, T1.2, T5.2, T5.3

Objectives

For Task 5.1

- Research and document examples of good practice in Open Learning. The DELTA contract calls for the study to embrace 5 producers and 10 users.

For Task 1.2

- Identify existing European networks for Open Learning.
- Propose methods of connecting the DELTA programme to these networks via ELTA.
- Disseminate the results of the market research conducted under action line V of this project to the DELTA projects.

For Task 5.2

- Evaluate the actual and potential demand for Open Learning in Europe.
- Identify the strategies necessary to promote the development of Open and Distance Learning in terms of both public and market strategies.
- Identify a model certification for quality and protection of users.

For Task 5.3

- Compare the Telecommunication Tariff policies within the EC and how they impact on distance learning technologies.
- Produce suggestion for tariffs to facilitate Distance Learning in Europe.

Technical Approach

The technical approach has been determined by the partners in relation to the four sub-tasks. All four tasks require research of existing attitudes as a starting point. Existing networks, good case studies and telecommunication tariff policies have to be identified. The market demand is to be assessed by means of postal, telephone, and face to face interviews in a sample of typical european regions.

The work builds on research data already available and extends to interpreting and presenting data in a way that is relevant to Distance Learning.

The first phase is therefore to research existing information and define methodology for survey.

The second phase consists of collecting new information using 800 questionnaires and follow up interviews.

The final phase is to present the information from the Tasks as widely as possible.

Key Issues

In the above project the key issues are:-

- Demand for DELTA Distance Learning products.
- Knowledge concerning what types of distance learning products are likely to succeed in the market.
- Policies required to promote Distance Learning.

Impact

Results to date:

- Fifteen case studies of successful distance learning products have been identified.
- Sample areas and methodology for market survey have been decided.
- Telecommunication tariff data for the EC has been collected.

Results anticipated

- Case study reports on 15 distance learning products including an analysis of their cost effectiveness.
- A report of likely demand for distance learning. Sampled regions are in France, Italy, Spain, Portugal and Germany and UK.
- Recommendations on telecommunications tariffs necessary to assist new distance learning products.

The overall outcome of the project will be to inform developers of products in the DELTA programme of the market conditions which will affect any exploitation. The data resulting from the project will itself be exploitable commercially as a marketing resource.

Major Reports

- **Report on Case Studies, 9/90**
- **Report on Market Demand, 9/90**
- **Report on Telecommunication Tariffs & Policy, 9/90.**

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P7113/D1024 - EXVOC - Expert System Contributions to Vocational Training

Participants	
Univ. Catolica Portuguesa, P	EXPERTECH LTD, UK Thames Valley College Higher Education, UK OMAS, GR

Work Programme Reference : Action Line V, Task T5.1

Objective

The main objective is to understand the potential offered by expert systems for vocational training. This will identify key barriers preventing their use and suggest initiatives which can overcome them.

Technical Summary

It is believed that the prime influence on the spread of Expert System contributions to vocational training will be governments and their agencies. The most practical assessment of future demand, over the next five years, is considered to be an investigation of the attitudes of Governments to, and their plans for, such facilities. It is proposed to draw scenarios and to obtain examples of these facilities, to present them to three governments and their agencies and to record their response. The three countries have very different socio-economic backgrounds.

An analysis of operational applications of Expert Systems shows they assist their users to make, on average, small improvements in their own performance. However they do enable those users to continue to improve their performance in small steps. It therefore seems sensible to aim these Expert System contributions toward small scale enhancements that can be achieved among many people.

The investigation into the demand for these open learning facilities, together with their probable social, fiscal and regulatory environment, require both written and verbal scenarios. These scenarios will have to be carefully designed to be achievable by, and relevant to, each of the surveyed key countries. Achievable, here, means that the identified areas are expected to be either a shared development or locally implementable largely from existing resources. Relevant means they appeal to perceptions of national interest. The scenarios will be supported by examples in the form of Expert System applications with a training purpose.

Key Issues

- Identification of major potential for expert systems in vocational training scenarios;
- Identification of major requirements for vocational training teaching aids;
- A market oriented analysis of the decision process concerning the adoption of Expert Systems in Vocational Training scenarios;
- Specific roles to be performed by public and pseudo public bodies for the above domain;
- Workplans and suggested actions for Community initiative in order to enable a market to develop for expert systems in vocational training.

Impact

- Results about availability and the quality of know how encapsulated in Expert Systems for Vocational Training;
- Data about the motivation of public and pseudo public bodies in the use of Expert Systems in Vocational Training;
- Generation of fundamental interest in a diverse set of community countries;
- Development of specific actions for community initiatives for the support of emergence of a market for Expert Systems in Vocational Training.

EXVOC	
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P7162 BIS-FACT : Distance Learning - Inhibiting Factors and the Creation of Favourable Conditions

Participants	
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BIA Applied Systems, UK	Creatividad Y Technologia, E
	BIS Mackintosh, F
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Work Programme Area/Task : AL V

Objective

The project will contribute towards assessing the problems associated with supply fragmentation, harmonisation and collaboration in the DELTA domain. It will assess these issues and contribute them to the relevant fora created under Action Line I (ELTA) in the domain of markets, technology, pedagogy and standardisation issues.

There will be research into the economics of ALT and the factors affecting the use of the technology in the problem area.

This will be directly used in projects **P7122 ETEE** and **P7113 EXVOC** who deal with specific problems in SME's and Expert Systems respectively.

P7026 PRO-DELTA will use the market projections for Portugal and France, and **P7209 OSIRIS, P7042 LEAST** will consider the standards issues identified for their own research directions.

Technical Summary :

A programme of field research with suppliers and users of Distance Learning in Europe (Fr, FRG, It, Sp, UK) and the US to determine the factors that have inhibited the use of Distance Learning and the actions needed to create favourable conditions for its use in Europe.

- Supplier research includes vendors of hardware, software and courseware.
- User research segmented between ten business categories.
- Focus Groups discuss above issues in Belgium, Denmark, Greece, Ireland, Luxembourg, Netherlands and Portugal.

Results

The results coming out of the studies and focus groups will help identify market barriers and develop means to overcome them. The findings will be published by the coordinating contractor to the widest possible audience, targetting especially vendors and users of distance and flexible learning services and systems.

BIS-FACT

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P7122/D1018 ETEE - Educational Technologies For European Enterprises

Participants

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TEAM, I
Univ. Genoa - Biophysics and Electronics, I
Jutland Technological Institute, DK
FUNDETEC, P
Saturn,NL

Workplan references : Action Line V

Objectives

The project deals with the study and the specification of conditions favourable to the development of educational technologies for training purposes within small and medium sized companies, ie those with staff of less than 500 people.

Specifically the objectives are :

- to characterise the specific contributions of the new educational technologies in the context of training for small and medium sized enterprises,
- to identify the obstacles to their implementation within the context of the above
- to develop and experiment with strategies based on broadcasting techniques, to recognise these obstacles and overcome them,
- to evaluate these and elaborate further proposals capable of promoting new educational technologies in the context of training in small and medium sized enterprises.

Technical Summary

The selected research topics are as follows:

- methodology of needs diagnosis,
- equipment accessible products and their adaptation,
- the integration of educational technologies within corporate culture,
- the supporting or slowing contributions from external training personnel,
- the supporting or slowing contributions of the institutional environment,
- the communication strategy for the promotion of educational technologies with the SMEs.

The second phase, with further activities defined from the results of the initial phase, will bear on experimentation with recommendations. It will lead, after assessment of the results, to a synthesis of the proposal in order to make the educational technologies accessible to the SMEs.

Impact

The impact of the project will be magnified in the regional context by a very close relationship with P7026, PRO-DELTA.

SME's have traditionally been prevented from access to flexible learning and benefits from economy of scale in such leading edge developments. This project aims to identify which barriers prevent this, and possible propagation strategies.

A regional model for diffusion of pedagogic technologies in the SME's will be available, which will match the needs of SMEs with the offering available from advanced learning technology.

It wil identify strategies for integration of learning technologies into the socio-technical context and the institutional environment of typical SME's.

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DELTA '90

Annex B

DELTA PREPARATION

B.1 A brief overview of the DELTA Preparatory Studies

The Learning Systems Reference Model examined the development of a model as a planning and management tool, to monitor execution and to enable assessment of progress and evaluation of options. The overall objective was to allow a series of scenarios for learner needs, organisational training programme, human factors and other functional parameters to be modelled in detail to differentiate different executive paths. This was intended to enable experience and technology transfer paths to be developed ahead of their critical need.

Impact, Assessment and Forecasting work focused on the complexity of learning as a human resource process under different types of learning and learning conditions, to see what impact the greater use of technology has in the learning scenario. Special reference was given to regional problems and the situation of SME's.

Possible Economies of scale focuses on the potential of reducing costs in quality courseware production, by developing standards in procedures and languages and environments. Cross cultural differences still need to be able to be expressed, and good quality software could have extended life by porting them to the new architecture.

The Learner Environment work developed an incremental approach to emerging dedicated learning stations, home learning stations, business learning stations and personal electronic libraries (a variation on the new computing paradigm of the Electronic Book). Interfaces, mass storage and training server needs, as well as help facilities are developed in depth.

Authoring facilities work developed the concept of an authoring workbench, which contained support tools for routine tasks in courseware, and tools for transparent components such as networking and or interactivity.

The Production Environment developed a full simulation of an operational system harnessed totally to the support of the creation of high quality, commercially viable learning components. Courses can then be assembled. Satellite links were also studied here.

Tutoring and Monitoring requirements were analysed in the sense of the development of communications allowing interaction, and automated support tools supporting the tutor in his monitoring role, and the student in minimising the need for tutor intervention.

Information Resource Management examined the required tools and functions to support the effective organisation and transfer of interactive access and information, of different formats. Help systems again were considered crucial in this domain.

Communications Services were also considered as an incremental issue. Existing services would have to be used initially with a gradual migration to ISDN and finally IBC; with extensive use of DBS satellite technology. There was groundbreaking work done for a European Educational Channel, and open test facilities to allow actors to gain more experience in the use of modern telecommunications. ESA offered substantial free time on its then new satellite Olympus as a result of this work.

Interoperability became a major issue. It means that different users can be "connected" to dissimilar parts of the same "picture" in a transparent manner. A help system on a local machine could support access to a remote database, for example. The two components could be used to drive each other to produce a unified effect to the user. There are physical problems and difficulties associated with standards and long term strategic aims of the market place. Nothing other than an Open architecture will finally support this.

Lastly, the creation of favourable conditions considered a number of disjointed issues that were seen to be crucial to the successful introduction of learning technology into the market place. These include:

- value added tax treatment
- indirect tax treatment
- regulatory conditions
- telecommunications tariffing
- electronic copyright provisions and policy.

B.2 Framework of the DELTA Pre Pilot Project for the LSRM.

THE DIMENSIONS

ACTIVITIES

MANAGE

GENERAL

- find resources
- control costs
- develop own skills
- review
- improve
- run project
- plan project
- set up project
- negotiate contract
- commission (external) producer
- negotiate copyrights

MARKETING

- set targets
- identify market
- decide on action
- investigate market
- define product
- stimulate use of learning material
- mediate with other organisations

SALES

- promote & advertise
- visit (potential) clients
- handle order
- supply
- invoice

SUPPORT

- engage staff
- train the tutor
- support after sales

FACILITATE

- subsidise
- sponsor
- legislate
- promote

STANDARDISE

- define application standards
- define quality standards

SUPPLY (tools and delivery systems, not Learning Material)

- supply delivery systems
- supply tools

DEVELOP (Learning Material)

SPECIFY (the requirements; product definition)

- study feasibility
- define Learning Environment
- analyse target population
- define aims
- analyse needs
- define prerequisities
- define curriculum
- define delivery system
- define delivery system
- define objectives
- define instructional strategies
- define presentation media
- define assessment criteria
- define assessment questions
- define layout
- define learner monitor
- define security measures

DESIGN (how requirements can be met by the product to be made)

- investigate existing learning material (off-the-shelf)
- modify existing learning material
- design new learning material
- analyse subject matter
- design structure of learning material
- write script (AC/CBT/Kit/Books)
- design layout
- design learner monitor
- design security measures
- design package
- develop prototype

PRODUCE (create)

- write course text
- record & edit Audio-Visual material
- code software
- make (experimentation) kit
- produce graphics
- test & debug modules
- write manual text
- write (technical) documentation
- transfer/translate

EVALUATE (during whole development process)

- check with client during development
- evaluate (formative) during development
- perform field test

ASSEMBLE

- integrate package
- test integrated package
- reproduce package
- store material

DISTRIBUTE

- administrate
- broadcast, download or mail learning material
- charge/invoice

USE

- counsel
- select learning material
- coach/tutor
- learn
- monitor

EVALUATE

- maintain
- evaluate (summative) learning material

ACTORS

It must be noted that the clustering of Actors as shown in the list below does not necessarily reflect the actual organisational structures. The clustering is aimed at optimal flexibility of the Framework. (This implies e.g. that a learning material developer could be part of the organisation of a publisher, although they are separate clusters in the Framework.

GOVERNMENT (permits/facilitates)

- Legislator/ministry of education

Central institutions which define the general curricula for each kind of educational institute and gives directives to the educational institutes about the use of their financial resources. This institution may have different degrees of centralisation, according to the reality of the different countries.

- -Validating body

Responsible for offering qualifications in various fields and for the quality control of the institutes offering courses for such qualifications.

- -Visiting committee

SOCIETY (requires)

- Professional body (e.g. employers)
- Sponsor

  Provides the resources, but has no direct influence on the content.
- Examiner

  Test the learner.
- Standardisation board
- Learner association

EXPERT / ACADEMIC BODY (knows)

- Subject matter specialist

  'Expert ~ with specialised experience in the area for which training is required.
- Professional institute

  Body representing industry, business or professional sectors. Sometimes act as client in commissioning projects.
- Librarian (academic)
- Evaluator (external)
- Collects data or participant reactions; writes evaluation report

MANUFACTURER (supplies delivery systems or tools)

- Marketing staff
- Sales staff
- Support staff

DEVELOPER (develops learning material)

PROJECT MANAGEMENT

- Project manager

Manager responsible for the business and operational management of a project to achieve financial, resource and time targets and to ensure client satisfaction.

SPECIFICATION STAFF
(makes functional specifications)

- Curriculum designer
- Technical specifier

Responsible for all significant technical and technological decisions advising on technical market issues and solutions.

DESIGN STAFF

- Instructional expert

A group (or an individual) which is in charge of the development of Learning Material given some general requirements. Is able to define the form and the contents of a course according to a specific target population, the learning objectives and some other constraints.

- Subject matter expert

PRODUCTION STAFF

- Producer (AV/CBT/Kit/Book)

A group or person committed to the production of (parts of) Learning Material, e.g. a courseware house.

- Production manager
- Writer

Writes textual content of Learning Material.

- Typesetter
- Editor (AV/Text)
- Graphic Designer (illustrator)

- User interface developer
- Programmer

ASSEMBLING STAFF
(integrates all multi-media material)

- Programmer
- Translator

Translates the Learning Material into other languages and/or cultures.

EVALUATION STAFF

SERVICES STAFF

- Librarian (of Learning Material)
- Computing services staff

PUBLISHER/SERVICER (mediates)

- Marketing staff
- Sales staff
- Implementation manager
- Warehouse manager
- Administrator
- Telecommunications Operator
- Legal expert

CLIENT (applies and defines)

- Spokesman

Identifies (in case of client-based Learning Material development) requirements

- Purchaser
- Implementation manager

Helping clients to understand, plan and set up for the effective use of Learning material at the practical level inside their organisations.

- Mentor

Assists the learner in selecting the appropriate Learning Material.

- Tutor

Coaches the learner to understand the subject matter.

- Learner (actual)
- Learner (potential)

RESOURCES

HUMAN SKILLS & UNDERSTANDING

Human Skills & Understanding can be related to:

EDUCATION

e.g.subject matter analysis, learning styles, instructional strategies, assessment, etc.

SUBJECT MATTER

e.g.geography, mathematics, history, data-communication, etc.

MANAGEMENT

e.g.planning, leadership, motivation, innovation, etc.

COMMERCIAL

e.g.market research, marketing, sales, public relations, etc.

PRESENTATION MEDIA

e.g.video/audio, text structure and layout, artwork, special effects (e.g. animation), etc.

INFORMATION TECHNOLOGY

e.g.software technology, networking, optical technology, computers, telephone, etc.

METHODOLOGIES

STANDARDS, concerning:

e.g.user interfaces, icons, digital communication protocols

GUIDELINES, concerning

e.g.layout, terminology, evaluation, feasibility study, etc.

PROCEDURES, for:

e.g.backup, quality assurance, marketing, planning, etc.

TECHNIQUES, for:

e.g.flowcharting, story-boarding, statistical analysis, critical path analysis, checklists, etc.

SOFTWARE

SYSTEM

e.g.operating system, windowing system, device driver, etc.

GENERIC

e.g.database, wordprocessor, graphic toolbox, programming language, expert system shell, planning system, etc.

DEDICATED (to Learning)

e.g.learner administration system, tutor-learner communication facility, storyboard tool, authoring language, etc.

HARDWARE

PROCESSING

e.g.personal computer, mainframe, etc.

STORAGE

e.g.CD, video tape, audio tape, book, etc.

COMMUNICATION

e.g.LAN, telephone, modem, satellite, etc.

INPUT

e.g.keyboard, mouse, touchscreen, microphone, scanner, etc.

PRESENTATION

e.g.monitor, braille device, speaker, printer, etc.

Framework of a DELTA Domain L.S.R.M.

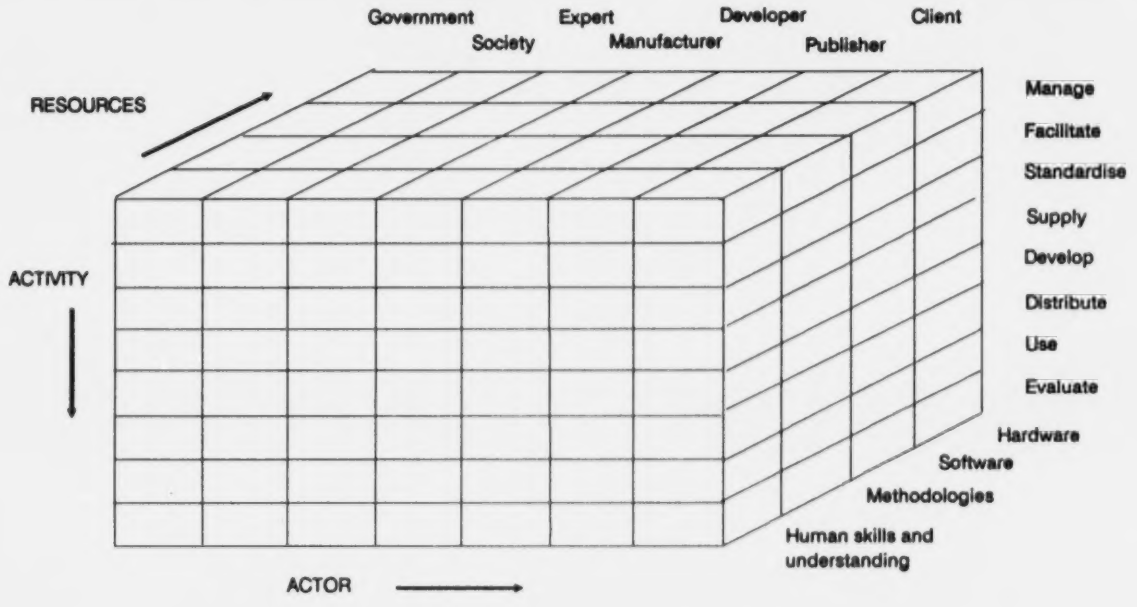


Figure 1.1 : The Multiple Dimensions of Learning Systems

APPLICATIONS OF THE FRAMEWORK

The emerging Framework for the LSRM could be applied for several purposes:

- **as a communication aid**: identifying a specific area of the DELTA problem space
- **as a 'blueprint' of DELTA:** to mark which clusters of cells are most relevant from a specific point of view
- **as a checklist**: to check whether each relevant cell (i.e. each relevant combination of Actor, Activity, and Resource) in the box is taken into account
- **as a 'map' of processes in European Learning Technology:** to mark routes (from one cell to another) which are followed to stimulate, develop, distribute, or apply Learning Technology products
- **as a classification of DELTA studies**: projects could be related to certain areas (cells or clusters of cells) of the box

Since it is often difficult to work with a three-dimensional representation of the Framework it is suggested to apply, whenever possible, only two dimensions at a time. By looking at one of the sides of the box only, a two-dimensional matrix which can be easily used:

- marking the cells which are relevant from a specific point of view
- writing certain aspect in each of the cells, e.g. the decision processes which are relevant to each cell
- drawing arrows from one cell to another, indicating the flow of information or semi-manufacturers between cells

An alternative application of the Framework is to 'cut a slice' of the DELTA Problem Space, thus 'fixing one of the variables' in order to limit the complexity. We could , for example, cut the slice corresponding to one Actor (e.g. the publisher) to look at the matrix of Activities and Resources as far as relevant to publishers only.

A crucial 'slice' of the Framework is the Software slice (at the dimension Resources). This slice defines the software which is required by each of the Actors in order to perform certain Activities in an effective way. It represents the merger of skills, understanding, and methodologies on one side and (system) software and hardware on the other. In this respect it specifies the required functionality of PETE (Portable Educational Tool Environment).

Another application of the Framework is to construct matrices which have the same topics on both dimensions. We could, for example, look at the interdependence (e.g. flow of information) between Actors by filling in an Actor x Actor matrix. This results in an identification of which Actors should be connected by a communication network.

ASSESSING THE FRAMEWORK

In order to assess the Framework in the light both of partners' contributions from their own experience and in the light of the prototypes, it was necessary to generate some assessment criteria.

The original premises upon which the LSRM were to be tested were somewhat vague. Towards the end of the study, the partners therefore developed the following criteria which should be met by any such generic model:

- It should be an adequate communication tool providing a general descriptive framework which can be applied to different European situations involving the development and distribution of learning materials.
- It should provide a guide to critical processes with in learning materials development and distribution.
- It should be able to serve as a reference tool relative to critical issues and problems related to learning materials development and use.

Assessment of the Framework against the three criteria set out in Chapter 6 shows that, in some limited areas, the Framework has good potential to contribute to the goal of elaborating an LSRM for DELTA.

In terms of being useful as an adequate communication tool, the Framework offers some potential for development. However, this development will be little more than a theoretical exercise, unless it takes into account the views of the practicing developers of technologically-advanced learning material. There is a dilemma of, on the one side, there not being enough detail to describe real activities and, on the other side, the need to avoid unmanageable complexity. Further work is needed to resolve this dilemma. Another area for development of the Framework as a descriptive tool is in the establishment of a DELTA database using the Framework descriptors as an indexing mechanism.

As a guide for critical processes, the Framework shows its best potential when the Activity axis is taken as the major axis. However, the complexity of visualising the path through the Framework implies that a computer-based method is appropriate and a hypertext-like implementation is suggested.

As a reference tool for critical issues, the partners found that the Framework could not easily be applied retrospectively to the papers published in the Pre-Pilot project as a means of identifying critical issues. a second problem was that the granularity of the cells of the Framework as expressed so far was too coarse to usefully applied. Imposing the structure of the Framework upon future DELTA reports and papers, together with the refinement of the cells, was seen as offering potential for progress towards the elaboration of DELTA LSRM.

DELTA '90

Annex C

DELTA Participants in Country Order

Note: This Listing references all contractors in DELTA within the country where the work takes place on the project. It is correct at 14.5.1990 but is subject to change. It does not include sub-contractors and associate partners

Belgium

1005 COMNET

1022 Int. Fed. for Computer-Based Education in Banking & Finance

1013 Katholieke Universiteit of Leuven

1027 Université de Louvain

1001 Université de l'Etat à Liège

1005 Université de l'Etat à Liège

1020 Université de l'Etat de Liege

Switzerland

1005 Departement de l'Instruction Publique

Germany

1025 AEG Olympia AG

1002 Akademie des Deutschen Beamtenbundes

1011 Berlitz Sprachschulen GMBH

1026 Bundesministerium fur das Post und Fernmeldewesen

1011 Condat GMBH

1007 Dornier GMBH

1014 Ernst Klett Verlag GMBH and Co KG

1025 Ernst Klett Verlag GMBH and Co KG

1023 Export-Akademie Baden-Wurttemberg

1003 Fern Universitaet

1015 Festo Didactic

1005 IPN

1023 Kommunikationsverbund Weiterbildung Berlin EV

1010 Standard Elektrik Lorenz AG

1012 TA Triumph-Adler AG

1015 TA Triumph-Adler AG

1023 Zentrale Universitatverwaltung Univ. Erlangen-Nurenberg

Denmark

1021 Aarhus Technical College

1021 AS Eccolet SKO

1019 Danish Enterprise University Systems

1018 Jutland Technological Institute

1021 Jutland Technological Institute

1028 Jutland Technological Inst. Computer Science and Technology

1021 Jutland Telephone Incorporated

1014 Technical University of Denmark

Spain

1028 ABSIS SA

1025 Fundesco

1027 Red Espanola de Atencion Primaria

1014 Tecnologia e Investigacion Ferroviaria Sociedad Anonima

1026 Telefonica de Espana

France

1010 Apigraph SARL

1002 Arcos Conseil

1020 Bull MTS

1001 Bull SA

1001 Centre Commun de Télédiffusion et de Télécommunications

1006 Centre d'Etudes Superieures Industrielles

1001 Centre National de la Recherche Scientifique

1005 Centre National de la Recherche Scientifique-IRPEACS

1010 Centre National de la Recherche Scientifique-IRPEACS

1023 Centre National Universitaire Sud de Calcul

1019 Chambre Regionale de Commerce et D'Industrie

1028 Chambre Reg. de Comm. et d'Industrie des Pays de la Loire

1018 Chambre Reg. de Comm. et d'Industrie des Pays de la Loire

1003 Chorus Systemes

1020 Commissariat a l'Energie Atomique

1011 Ecole Europeene des Affaires

1023 Editions du Logiciel d'Enseignement

1021 Europace

1002 IMEDIA

1018 Institut Universitaire de Technologie-Université de Nantes

1018 Interformation Pays de la Loire

1005 OTE

1015 RCDEE Castagnary

1001 SESA

1002 Soc. Francaise D'Etudes et de Realisations D'Equipement

1015 Sodicom

Greece

1007 Computer Technologies Company, Training Systems Limited

1014 Computer Technology Institute

1002 Dialogos-Nea Media

1015 Eommex

1016 HITEC

1004 Info Group Consultancy Services

1017 Integrated Information Systems Limited

1006 Intrasoft SA

1024 OMAS

Italy

1028	AF Forum Associazione
1006	Agusta SPA
1002	Applied Research Group SPA
1017	CITAM
1012	Consiglio Nazionale Delle Ricerche
1012	Consorzio per la Ricerca e le Applicazioni di Informatica
1017	Consorzio Per L'Universita a Distanza
1028	CSEA - Consorzio Sviluppo Elettronica e Automazione
1010	Datamat Ingegneria dei Sistemi SpA
1002	Datamont SPA
1007	Dida*el SRL
1005	Dida*el SRL
1004	Dida*el SRL
1017	Dida*el SRL
1009	Dida*el SRL
1016	Dida*el SRL
1015	Editoria Elettronica Editel SRL
1017	Euroconsult
1015	Fabbrica Italiana Apparecchiature Radioelettriche
1015	Iatin
1017	Instituto Bancario San Paolo Di Torino
1017	ISFOL
1017	Metrotec
1017	Provincia Regionale de Catania
1018	Scienter
1017	Scienter
1017	Scuola Radio Elettra
1012	Societa Italiana per L'Esercizio Delle Telecomunicazioni
1026	Societa Italiana per L'Esercizio Delle Telecomunicazioni
1015	Societa Italiana Sistemi Informativi Ellettronici
1018	Team SRL
1028	Team SRL
1012	Tecnopolis Csata Novus Ortus
1015	Telespazio SpA
1017	Universita di Bologna
1028	Universita di Genova
1018	Universita di Genova

Ireland

1019	Educational Research Centre
1002	Freetext Technology Ltd
1007	Irish Medical Systems
1017	National Institute for Higher Education
1023	System Dynamics Limited
1002	University College of Cork
1008	University College of Dublin
1014	University College of Galway
1027	University of Dublin

Luxembourg

1020 European Institute for Information Management

1022 Societe Europeenne des Satellites

Netherlands

1008 Courseware Europe BV

1001 Courseware Europe BV

1014 Courseware Europe BV

1014 Educational Computing Consortium BV

1025 Educational Computing Consortium BV

1014 Eindhoven University of Technology

1009 Foundation Research Institute for Knowledge Systems

1009 Open Universiteit

1025 Philips Gloeilampenfabrieken NV

1014 Philips International BV

1002 PTT Research Telematics Laboratorium

1013 Rijks Universiteit Groningen

1019 Saturn

1018 Saturn

1017 Saturn

1014 Uitgeversmaatschappij Argus BV

1027 University of Amsterdam

1001 University of Amsterdam

1014 University of Amsterdam

1022 VNU Verenigde Nederlandse Uitgeversbedrijven BV

1009 Volmac Software Groep NV

Portugal

1004 Associacao Portuguesa Para a Qualidade

1021 Eccolet Fabrica de Sapatos LDA

1018 Fundetec

1019 Fundetec

1021 Fundetec

1005 GIS, Universidade de Coimbra

1019 Instituto de Apolo as Pequenas e Medias Empresas Industriais

1021 Instituto de Engenharia de Sistemas e Computadores

1019 ITEC

1021 Universidade Aberta

1006 Universidade Aberta

1019 Universidade Aberta

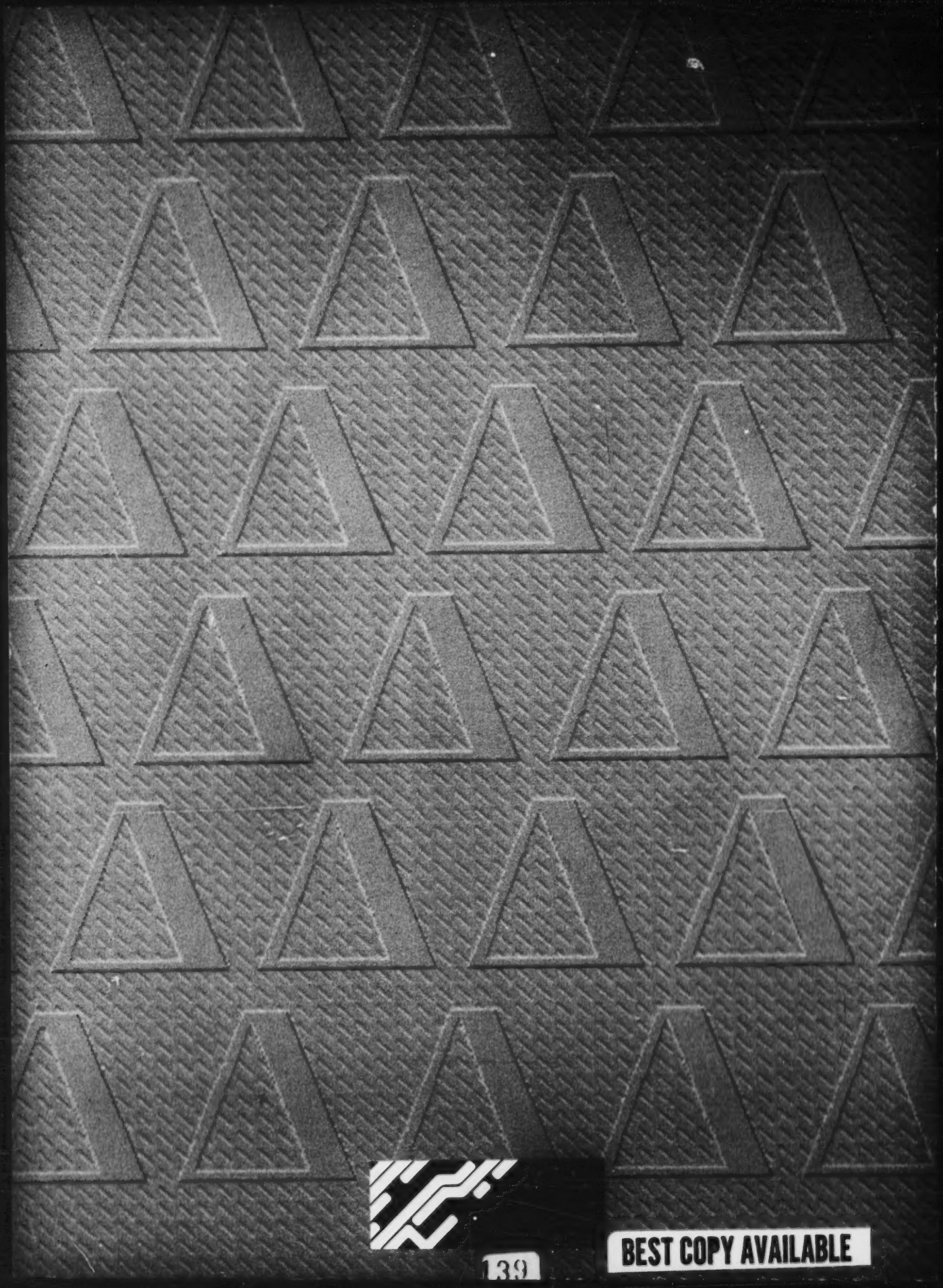
1020 Universidade Catolica Portuguesa

1024 Universidade Catolica Portuguesa

1013 Universidade de Lisboa

United Kingdom

1004	BICC Technologies Limited
1009	British Hydromechanics Research Association
1027	British Medical Television
1023	Coventry Polytechnic
1022	European Institute for the Media
1024	Expertech Ltd
1017	Guildford Education Services Ltd
1003	Harlequin Limited
1028	Henley Management College
1006	Husat Research Centre, Loughborough University of Technology
1002	IMSL
1004	Kingston Polytechnic
1008	Logica UK Ltd
1025	Macmillan Intek Limited
1006	Mari Advanced Microelectronics Ltd
1001	Mari Advanced Microelectronics Ltd
1014	Office Workstations Limited
1010	Open University
1003	Open University
1025	Open University
1012	Open University
1013	Oxford Educational Resources Limited
1012	Scottish Council for Educational Technology
1004	Technet Investments Ltd
1013	Teletape Video Ltd
1024	Thames Valley College of Higher Education
1013	University College of London
1012	University of Exeter
1007	University of Lancaster
1016	University of Lancaster
1005	University of Lancaster
1014	University of Leeds
1013	University of London
1006	University of Newcastle-Upon-Tyne
1027	University of Nottingham
1014	University of Strathclyde
1027	University of Surrey
1008	University of Ulster
1006	Yard Consulting Engineers Limited



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